PIT AND QUARRY

MAY 1947

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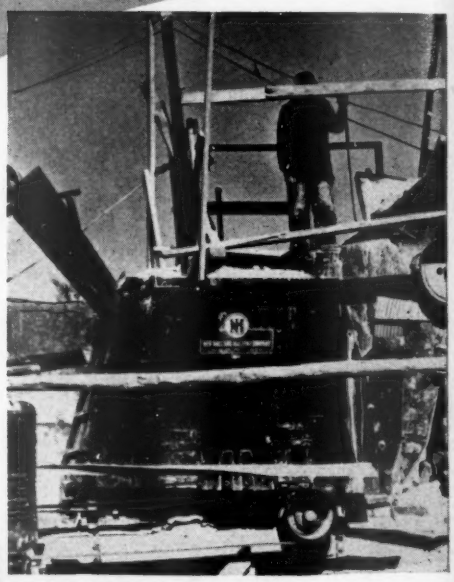

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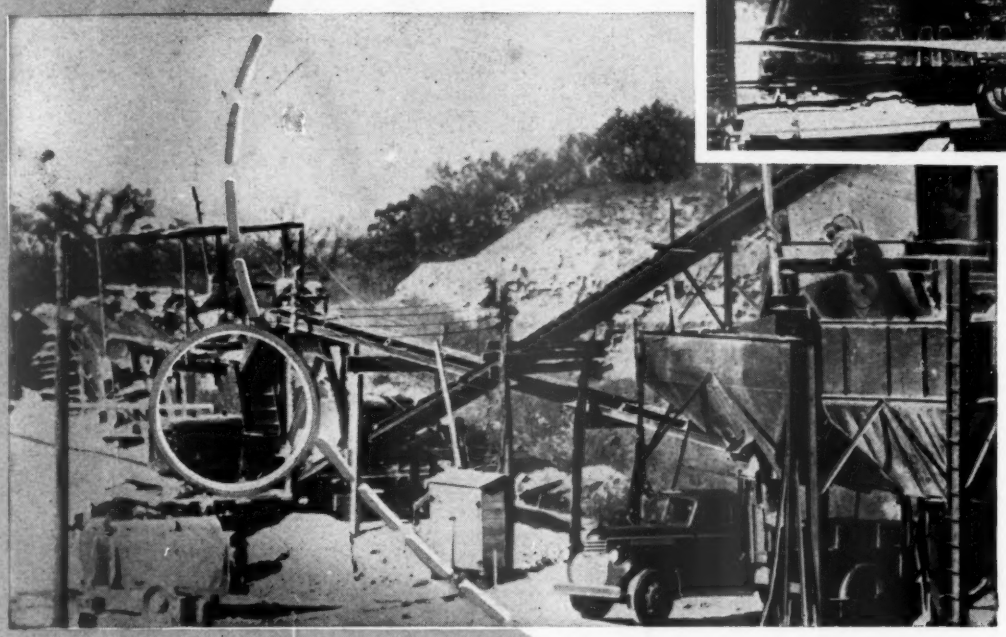

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P-24

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PIT AND QUARRY

MAY 1947
Vol. 39 No. 10

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MEMBER AUDIT BUREAU OF CIRCULATIONS

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To subscribers: Date on lower right-hand corner of envelope indicates issue with which your subscription expires. In writing to have address changed, give old as well as new address.

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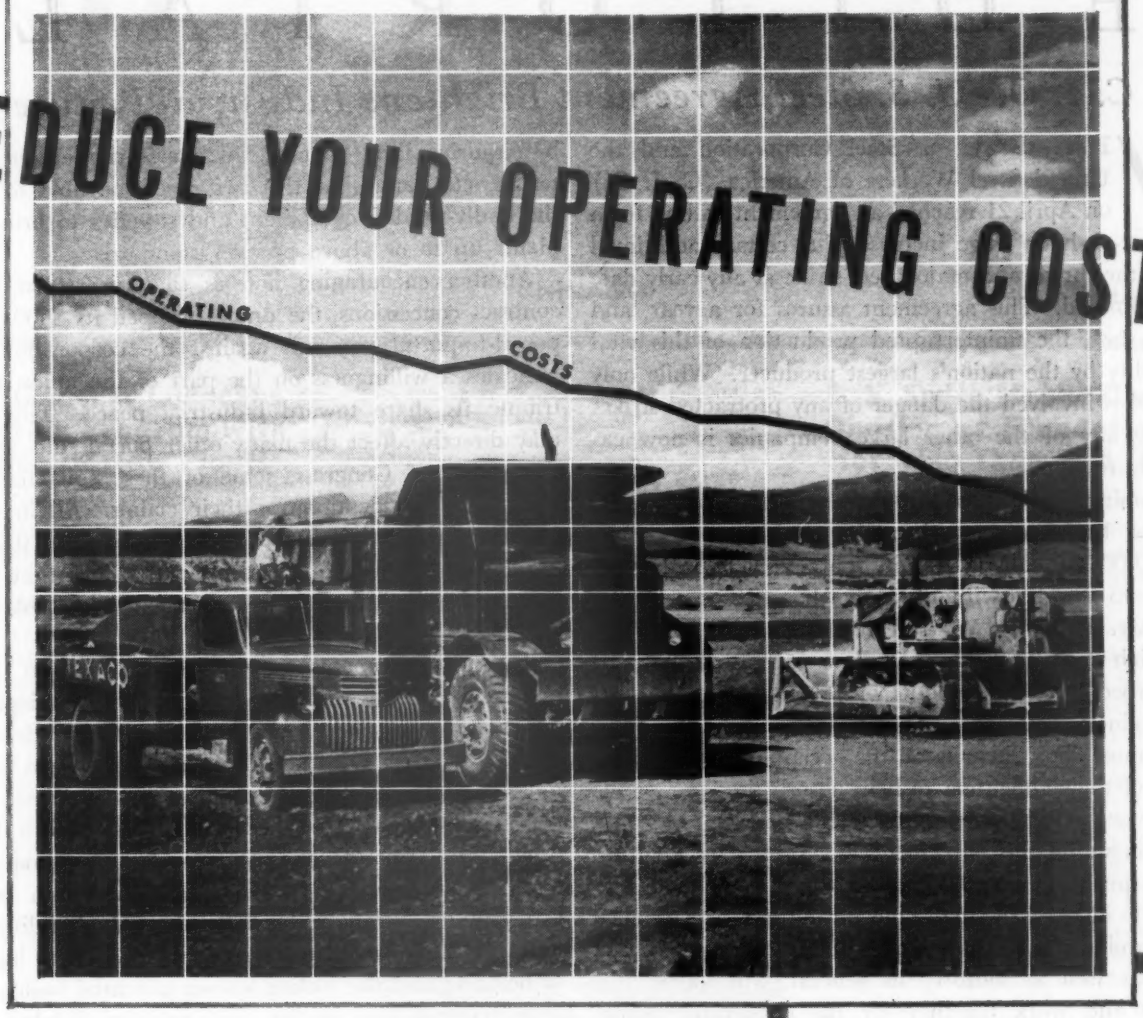

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EDITORIAL

C. I. O.-U. S. Steel Agreement Brightens Industrial Picture

WHEN the U. S. Steel Corporation and the United Steel Workers of America (C. I. O.) on April 21 reached an agreement calling for a 12½-cent-an-hour wage increase plus certain additional benefits the threat of a major steel strike at any early date was eliminated. This agreement assures for a year, and possibly two, the uninterrupted production of this vital commodity by the nation's largest producer. While only Big Steel is involved the danger of any protracted strikes affecting any of the other large companies is now exceedingly remote.

Benjaminu F. Fairless, president of U. S. Steel Corp., estimated that the wage increase would cost the firm $75,000,000 annually and said that every effort would be made to absorb it without raising the price of steel. To quote Mr. Fairless, "We sincerely hope that with existing high levels of operations, these increased costs can be absorbed within the limits of present prices for our steel products.

"We must count heavily on the acceptance by our employees of their obligation to help absorb these new costs by increased effort and improved efficiency."

In concluding this agreement, U. S. Steel is counting on the spirit of fair play and cooperation among its workers to increase the man-hour output, and is gambling on the probability that workers and the other steel companies, as well as industry in general, will follow this example and work together for the cooperative effort which alone can insure maximum industrial production and prosperity for all.

To nonmetallic mineral producers this agreement is also assurance that one of its biggest customers will soon be requiring large tonnages of flux stone, refractory materials, etc., and that they will soon be able to obtain the badly-needed equipment and supplies to bring their plants up to or above pre-war standards.

Another encouraging note is that, in return for the contract concessions, the union dropped its $500,000,000 portal-to-portal pay suit against the corporation. This indicates a willingness on the part of the union to contribute its share toward industrial peace. This action may directly affect the many other portal suits awaiting the action of Congress, some of these suits having at least some justification for their claims. All in all the prospects for industrial peace are now brighter than they have been in some time and indications are that we are now in the final phase of reconversion to a stable peacetime economy.

These developments may have come just in time to prevent a business recession from becoming a depression. Much as we dislike the ever-present prognosticators of doom it must be admitted that there have been growing indications of a falling off in business in general. There is no doubt about the fact that there has been a decided falling off in construction activity in most areas, even allowing for unreasonably bad weather. Even building trades union officials admit that the Spring building boom is so far a flop and attribute this chiefly to the high cost of building and the feeling among potential builders that costs may rise even higher. The promise of labor peace, of a leveling off of prices with possible decreases when our industrial machine really gets rolling at peak capacity, and of an increasing supply of much-needed materials and equipment should do much to encourage building.

Sell Your Scrap Iron Now

DURING the war most producers of nonmetallic minerals, like nearly everyone else, did what they could to help the war effort along by contributing liberally to various drives such as the Red Cross, Victory Bonds, scrap iron, etc. With the end of the war most of these needs dropped back to normal levels and contributions dropped with them. One exception, however, is scrap iron, which is as important now to our peacetime economy as it formerly was to our war effort.

This shortage was emphasized recently by William A. Danner, president of the Associated Equipment Distributors, in announcing the opening of a drive among the 1,000 distributor and manufacturer members of that organization. They were requested to send all their scrap to the nearest scrap iron dealer. According to Mr. Danner the shortage of scrap iron and steel threatens to seriously curtail the production of steel, thereby causing a further slowing of deliveries of construction equipment.

Mr. Danner said that a severe drain was made upon the supply of scrap to keep wartime production going at top speed. The scrap iron drives which met these needs used up much of the scrap available and little of this was replaced from the usual sources. Huge tonnages of iron and steel were lost through the shipments overseas and ship sinkings and the shortage of automobiles has also held down this once large source of scrap.

A. E. D. members were told that "anything made of iron or steel is valuable as scrap—old construction equipment, parts, pipe, worn-out tanks, boilers, etc." We pass on to nonmetallic mineral producers the suggestion that this is the time to dispose of any old scrap which may have been overlooked during the war or which may have accumulated since. Prices for scrap may never be higher.

Walter E. Trauffer

Natl. Gypsum Launches Expansion Program with Erection of New Plants

The National Gypsum Company's large-scale expansion plans at Baltimore, Md., were recently put into execution when the firm's president, Melvin Baker, participated in the cornerstone-laying ceremonies for a $6,000,000 plant. The city of Baltimore will build a $1,519,000 pier to serve the new facilities at the rate of 500 tons of gypsum per hour.

National's new plant in Baltimore will include a mill building, a board plant, a powerhouse and office, an employees' service building, maintenance shops and a garage. Officials expect to produce gypsum plaster at the rate of 90 tons per hour.

The company's new $1,000,000 facilities at Rotan, Tex., are scheduled to be completed in July. At Medicine Lodge, Kan., a long-range expansion program has been launched with the purchase of $60,000 worth of new equipment. It is anticipated that output of plant and mines will be doubled. Alterations and improvements requiring several years are expected to reach a total expenditure of $1,000,000 at Medicine Lodge.

According to a recent announcement, the company plans a $600,000 expansion program for its Niles, O., plant, where John J. Manofsky is general manager.

At Kalamazoo, Mich., National has begun a modernization program in a plant purchased from the Western Board and Paper Company. Leonard L. Hank, plant manager at Kalamazoo, stated that the improvements would cost approximately $500,000.

Appointment of Arbitrators Now Up to Labor Secretary

Former Chairman Phillips L. Garman of the National Wage Stabilization Board has announced that hereafter employers and unions seeking appointment of arbitrators by the board are referred to the Secretary of Labor. (The National Wage Stabilization Board officially expired on February 24, under executive order of the President.)

Mr. Garman stated that many unions and employers in collective bargaining agreements had designated the National Wage Stabilization Board or its predecessor, the National War Labor Board, as the agency authorized to appoint arbitrators, and that Executive Order 9672, of December 31, 1945, gave the Wage Stabilization Board the authority to appoint arbitrators, if necessary, under War Labor Board orders or collective bargaining agreements.

Blaine S. Smith

Coming Events

May 5-8, 1947—Hot Springs, Va. 29th annual convention, National Lime Association, The Homestead.

May 14-16, 1947—Hot Springs, Va. 12th annual meeting, National Industrial Sand Association, The Homestead.

June 16-20, 1947—Atlantic City. 50th annual meeting, American Society for Testing Materials, Chalfonte-Haddon Hall.

B. S. Smith Heads Cement Division of Foundation Hororing Thomas A. Edison

Blaine S. Smith, president of the Universal Atlas Cement Company, has accepted the chairmanship of the Cement Division of the Thomas Alva Edison Foundation, Inc.

The Edison Foundation, organized last year by a group of the nation's industrial and business leaders, is seeking $2,590,000 in a nation-wide solicitation to carry out the following objectives:

1. To acquire and preserve the Edison library and laboratories at West Orange, N. J.
2. To set up there, at the suggestion of Charles F. Kettering, vice-president and director of research for General Motors Corp., the Edison Center for Discovery, Research and Invention.
3. To restore the nationwide Edison scholastic competitions which were sponsored by the famous inventor in the last two years of his life.

Harvey S. Firestone, Jr., president of Firestone Tire and Rubber Co., is national chairman. Leaders in 30 industries which profited most directly from Mr. Edison's inventions are participating in the campaign.

Electric Processing Furnace To Improve Idaho Phosphate

J. R. Simplot of Caldwell, Utah, president and operator of the Simplot Phosphate Fertilizer Company at Pocatello, Ida., recently announced plans for a more extensive use of electric power in processing Idaho phosphates.

An electric furnace processing plant will be constructed on the Fort Hill Indian reservation between Pocatello and Blackfoot. By adopting new methods of processing, Mr. Simplot hopes to increase the quantity of plant foods contained in the fertilizers from 18 percent to 48 percent.

Sale of the Western Borax mine at Boron, Calif., was announced by R. E. Allen, receiver appointed by the court for the property. The buyers are Harvey S. Mudd, Seeley G. Mudd, Henry T. Mudd and George D. Dubs. The purchase price was $500,000, subject to court approval.

Pacific Coast Aggregates Opens New Headquarters Building at San Francisco

Pacific Coast Aggregates, Inc., has completed its modern San Francisco headquarters at 400 Alabama St. The largest organization of its kind in Northern California, P.C.A. has 48 offices, plants and warehouses, strategically located throughout that area. Producers of sand and gravel and ready-mixed concrete, they also distribute 17 general types of building products, including masonry materials, roofing materials, prefabricated buildings, refractory materials, paints and adhesives, and many others.

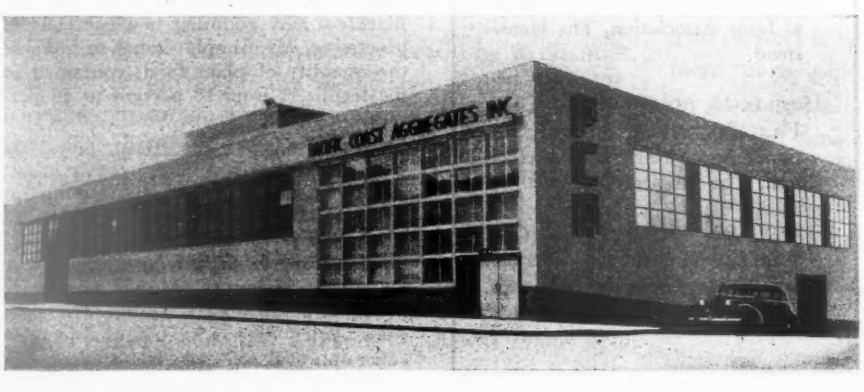
Their new headquarters is an outstanding example of a safe and modern reinforced concrete building. Scientifically designed for the welfare of their employees, the new building boasts a wide variety of advanced construction features, one of which is a unique water-filled roof that keeps roofing materials from burning out, and assures cooler interiors in the warmest weather.

The entire P.C.A. edifice is soundproof and fireproof. Irritating sounds are swiftly absorbed in the soundproof ceilings while huge and decorative asbestos sliding doors guarantee quiet and added safety in the luxurious, well-planned executive surroundings.

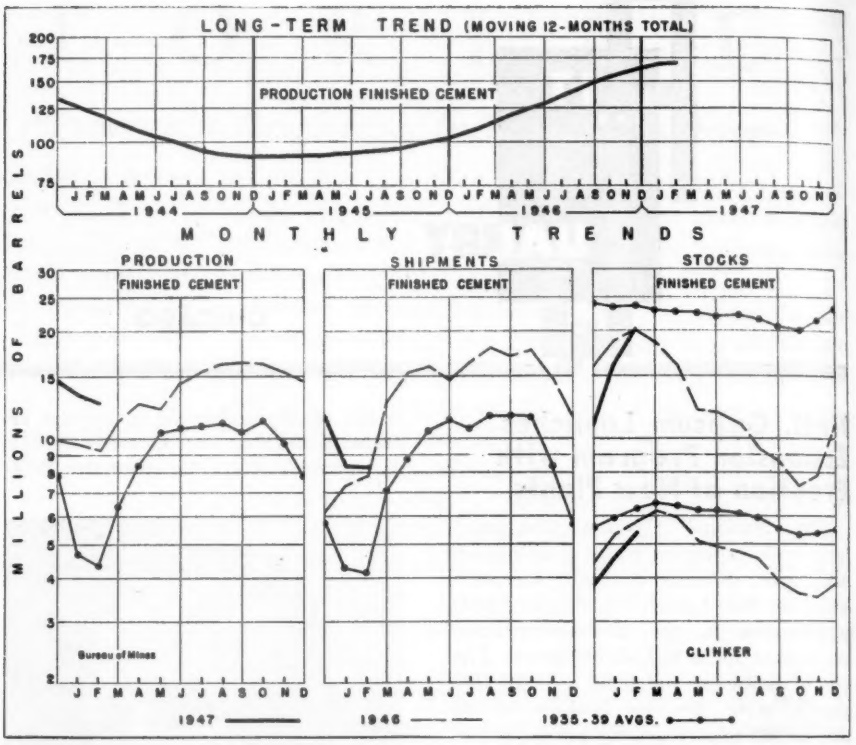
Located in the building's penthouse is the engineering department of Pacific Coast Aggregates. Here, in glassed-in surroundings, draftsmen and other technical experts have the benefit of completing their intricate work under natural light.

Adjoining the clean, compact engineering division is a modern lunchroom which serves between 50 to 100 well-balanced lunches per day to P.C.A. employees and is operated by the company as a non-profit cafeteria. Coffee is served workers during their mid-morning and afternoon relief periods.

This remarkable reinforced concrete building also contains enormous storage facilities. The entire main floor, plus a large section of the mezzanine is used as a warehouse for the storage of various types of building materials. Trucking facilities are available, together with freight elevator service.



• The newly-completed headquarters of Pacific Coast Aggregates, Inc., in San Francisco.



Production of 12,521,000 barrels of cement in February, 1947, reported to the U. S. Bureau of Mines, was 35 percent greater than that reported for February, 1946. Shipments of 8,347,000 barrels were 6 percent above those reported in the same month of the previous year. The relatively small increase in shipments is attributed to the usual seasonal trends of curtailed construction in the cold weather months in many parts of the country. Clinker production of 13,408,000 barrels was 38 percent above that reported for February of 1946. The industry in February, 1947, operated at 68 percent of capacity in comparison with 50 percent as reported in February, 1946. Mill stocks at the end of February, 1947, were essentially the same as those reported for February of 1946.

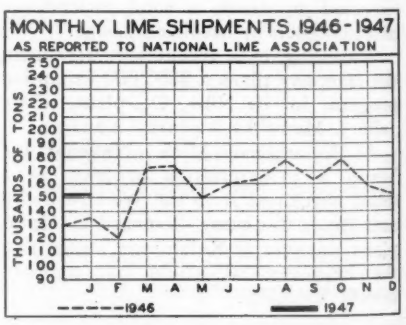
Demand for cement, as indicated by mill shipments, was higher in six districts and lower in 12, than that reported for February, 1946. The Hawaiian plant has been closed permanently and dismantled.

The long-term trend in production of finished cement, as indicated on the accompanying chart, continues upward, increasing since November of 1946 at the rate of three to three and three quarter million barrels per month. Monthly production, shipments, and stock trends are also shown.

Huron Portland Cement Spends $310,000 on Harbor

The Huron Portland Cement Company, Alpena, Mich., is spending $310,000 for harbor improvements. H. R. Schemm, assistant general manager of the company, said that the work entailed expanding and increasing the depth of the harbor, and repairing the 30-year-old breakwater.

The company operates six freighters—the *Crapo*, the *Alpena*, the *Boardman*, the *Conneaut*, the *Wyandotte* and the *Huron*.



According to data collected by the National Lime Association, 45 companies in January, 1947, shipped 152,538 tons of lime (96,619 quicklime; 55,919 hydrate). Reporting companies represent 42.3 percent of the association members' total capacity of record. Based on Pit and Quarry's estimates for the remainder of the industry, the total shipments for the month by all plants were approximately 397,000 tons. Shipments of lime by users for January, 1947, were:

	Quicklime (tons)	Hydrate (tons)
Agricultural	1,223	7,909
Building	9,282	24,159
Chemical	86,114	23,729
Total	96,619	55,919

Grahams Install Gantry Crane to Expedite Stockpiling and Rehandling

Early this year a Colby full-revolving gantry crane was placed in service at the El Monte, Calif., plant of Graham Bros., Inc., for the primary purpose of stockpiling and rehandling sand in the yard.

The crane, engineered and installed by Industrial Engineering & Equipment Co., Los Angeles, replaces the tractor-bulldozers which formerly were assigned to this task.

The wet concrete and plaster sands, first stockpiled for drainage, are later rehandled by the crane to build up dry cones above a loading tunnel through which delivery trucks drive to be loaded from gates in the tunnel roof. It is of incidental interest that the 16-ft.-diameter tunnel is a section of steel form originally used to construct the Metropolitan Aqueduct which now brings water to Los Angeles from Parker Dam on the Colorado River.

The crane, equipped with a 100-ft. boom and an Owens 3-cu.-yd. clamshell bucket, has proved so fast and maneuverable that, in addition to its primary duty of handling the sand, it is also being used to stockpile gravel and load yard bins, the track over which it operates having recently been extended to 400 feet. It is eventually planned to lengthen the track to a total distance of 1,200 feet, allowing the crane to stockpile material at either side. When this is done, a long loading tunnel will be constructed on one side of the track and the gantry crane, because of its speed of travel and high handling capacity, probably will assume the entire job of material rehandling.

Several new multiple-deck screens are also being installed at the El Monte plant this year. These will include three Stephens-Adamson units, two Simplicity screens, and a 5- by 12-ft. 2-deck Robins Gyrex, the latter to replace an old primary scalper.

• The big gantry crane in action.

Natl. Gypsum Co. Executives Re-elected by Stockholders

All officers and directors of the National Gypsum Company were re-elected at the annual stockholders meeting in Buffalo.

L. R. Sanderson, director of construction and reconversion, reported the completion of several projects in the firm's $20,000,000 expansion program.

Tariff Commission Urges Stockpiling of Mica by U. S.

The Tariff Commission has recommended to Congress that government stockpiling of mica be continued. A caution was expressed against reviving wartime subsidy measures to increase the production of mica in the United States and other countries of the Western Hemisphere.

The commission further suggested the simplification and reduction of the present eight classifications of mica and the substitution of ad valorem rates of duty for the current system of rates.

L.I.M.E. to Build New Plant With 300-Ton Daily Output At Bellefonte, Pennsylvania

Plans and specifications for a new lime plant to be located on the Bellefonte Ledge are being drawn by Lime Industry Management and Engineering, Hershey, Pa., consulting engineers.

The new plant will be designed for an initial capacity of 300 tons of lime per day and will contain two rotary kilns direct-fired with powdered coal. Auxiliary equipment for the production of a complete line of lime and limestone products is being provided.

The property for the proposed operation has been acquired and extends approximately 7300 feet along the Bellefonte Ledge immediately to the west of the present National Gypsum Company holdings. The plant will be erected in the vicinity of the chemical station on the Bellefonte Central Railroad.

Early development of the deposit will employ surface extraction methods for a period estimated at from three to five years, during which preparations will be made to move to underground workings as the surface deposit is depleted.

It has been indicated by L.I.M.E. that the plans now under way include provisions for expansion of plant capacity to 600 tons of lime per day, and for a corresponding capacity increase in raw stone products.

Stripping operations and construction have been begun at the site of the proposed plant, which is scheduled to go into production at the earliest possible date. This new development marks the third major kiln plant to take advantage of the high quality rock found in the Bellefonte Ledge.

Calaveras Reports Immense Backlog of Unfilled Orders

Stockholders of the Calaveras Cement Company of San Francisoo were recently informed that there were on hand (December 1, 1946,) unfilled orders to the amount of approximately $1,350,000. President William W. Mein also announced the firm's new recapitalization plan, soon to be voted upon by stockholders.

In an effort to reduce the great backlog of orders, the largest in the company's history, production has been pushed to 7,000 barrels daily. About 250 workers are currently employed, some in departments which run two shifts, others in three-shift sections.

Are you contemplating the production of ready-mixed concrete —concrete blocks—concrete pipe? Separate chapters in the Pit and Quarry Handbook give you the latest and most complete information on them.

Columbia Portland Cement Company at Spokane Headed by Otto C. Frei

Otto C. Frei has announced that the firm formerly known as the Washington-Idaho Lime Products Company has undergone reorganization and is now operating under the name of the Columbia Portland Cement Company of Spokane, Wash. Mr. Frei continues as president of the new company.

Operations formerly carried on by the old firm at Orofino, Ida., have been permanently terminated, Mr. Frei stated. A new plant with a capacity of 1,500 barrels per day is to be built in the immediate vicinity of Spokane. Designs for the plant and quarry are rapidly nearing completion, and construction will be started this summer.

Floridin Company Acquires Government Wartime Plant

According to an announcement released by the War Assets Administration, the Floridin Company of Quincy, Fla., has purchased the government-owned fuller's earth nodulite plant at Ellenton, Fla., for $102,000, the highest bid submitted for the property.

The Ellenton plant, where fuller's earth was converted into a lightweight coarse aggregate used in construction of concrete ships during World War II, was closed about two years ago after having been ruled surplus property. The facilities represent a government investment of about $500,000. Despite the interval of idleness, the machinery is said to be in good condition and the plant is ready for operation.

Maintain Safety Rules for Bigger Profits—Natl. Council

An eye-catching cartoon of a victorious boxing champ flashing a moronic grin is the lead of the National Safety Council's appeal to American industry in its current membership drive. From the warning to the winner that it is "a poor time to relax," with the vanquished adversary threatening a comeback, the bulletin develops the appropriate reminder that "A Good Safety Record in 1940 Doesn't Protect You Today." Potential members are urged to act upon the demonstrated fact that industrial safety results in increased profits and better worker relations.

Accompanying the bulletin are a "service guide" and a blank containing information which describes the various services offered by the Council.

Annual Needs for Carolina Roads Put at $80,000,000

An outlay of $80,000,000 annually for the next 10 years will be necessary to bring the highways of North and South Carolina "up to standard," it was estimated by members of the Carolina Road Builders Association at their recent annual meeting in Columbia, S. C.

The former officers of the association were re-elected. E. H. Hines of Greenwood, S. C., is president of the organization.

American Rock Wool Corp. To Increase Production

According to officials of the American Rock Wool Corporation of Wabash, Ind., the capacity of the firm's plant in that city will be increased by 20 percent through the addition of 5,000 square feet of space.

Already installed are a new cupola and mechanical handling equipment for the rock wall. Trial runs have been made on each of the new units. It was also announced that the personnel of the plant would be increased by 10 percent.

1946 American Gypsum Supply Is Industry's All-Time High

According to reports from the U. S. Bureau of Mines, the mine output of crude gypsum in 1946 was 5,614,568 short tons, a figure reminiscent of 1925, when 5,679,300 tons were mined. However, even 1925 was surpassed in the total quantity of gypsum handled in the United States in 1946. Booming imports of Canadian gypsum set a record of 1,457,140 tons, making the apparent supply (production plus imports) 7,071,708 tons, a figure unsurpassed in gypsum history.

Building materials showed the largest increases, but non-building uses were also higher than in 1945. Notable were the gains in basecoat plasters, lath and wallboard.

$1,000,000 Expansion Plan Mapped for New Orleans Plant of Lone Star

To meet the present extraordinary demand for cement, the Lone Star Cement Corporation has completed plans for enlarging the productive capacity of its New Orleans plant. The additional facilities consist of a 385-foot kiln, with a capacity of 2000 barrels a day, together with the installation of a large combination mill for raw grinding and a new finish grinding unit, to bring the total capacity of the plant up to 6000 barrels daily.

This program involves an expenditure in excess of $1,000,000, and contracts are being placed for the delivery and installation of the necessary equipment. Work will be pushed with the utmost speed.

Former CPA Functions Are Given to Housing Office

Certain functions of the Civilian Production Administration were transferred on April 1 to the Office of the Housing Expediter. Housing-Expediter Frank R. Creedon pointed out that while the functions being taken over from the CPA have bearing on the entire housing program, they apply directly to three major points of that program:

1. The construction limitation order (VHP-1) which presently restricts non-housing construction to an average of $50,000,000 a week and which also governs housing construction.

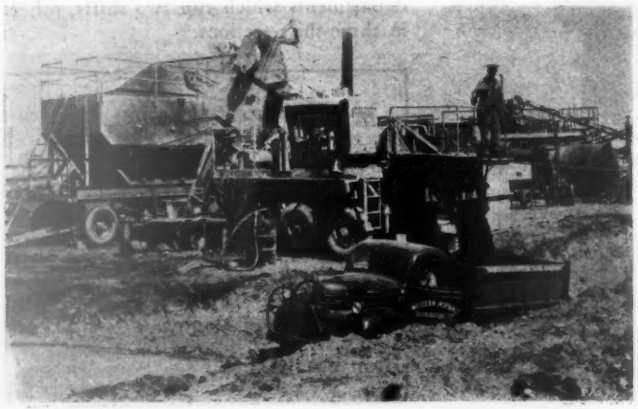
2. The allocation of a few basic raw materials, such as pig iron, to producers of building materials in critically short supply.

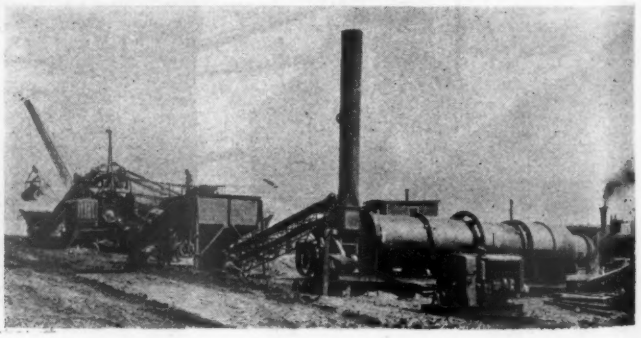
3. Special assistance to building materials producers in securing necessary equipment and machinery, through PR-28.

Mr. Creedon re-emphasized that all housing and non-housing controls taken over by him from the Civilian Production Administration are being continued.

He made this statement because of reports from several sections of the country indicating misunderstanding of the situation and a belief on the part of some that present restrictions on non-residential construction are being dropped.

• "Caterpillar" D8800 and D13000 diesel engines supply the power for a Pioneer crushing plant (left) and a homemade drier (below) owned by the Standard Gravel & Surfacing Company, Ltd., of Calgary, Alta., Canada. Operating at a site near Dewinton, Alta., the firm is applying material for 40 miles of highway.





British Cement Executive Urges Greater Effort and Increased Production

The necessity for increased output, through harder effort, in the cement industry in Britain has been stressed by Halford W. L. Reddish, chairman and managing director of the Rugby Portland Cement Company, Ltd., speaking at the annual general meeting of the company.

Discussing British cement policy, Mr. Reddish stated: "Deliveries of cement by the whole industry in the home market showed an increase in 1946 of 62 percent over 1945, but were still some two million tons below the total for 1939. In anticipation of further recovery during 1947, the Cement Makers' Federation announced in November, last, a reduction of 2s. per ton in the price of cement, notwithstanding a continued rise in many of the direct costs of production. It will be appreciated that, as the cost of cement is such an insignificant part of the total cost of any building, this reduction can have little practical effect on building costs generally, particularly in the case of house building, where the amount of cement required is very small. But it was a good will gesture on the part of the cement industry, and an earnest of its determination to revert as quickly as possible to its prewar policy, once the shackles of control are lifted.

"Profit margins in this industry are small, and the future course of selling prices must necessarily depend on the one hand on the extent to which direct costs are stabilized, and on the other on the rapidity with which demand and production can reach pre-war levels. Further it must not be forgotten that the cost of new plant will be substantially in excess of double the cost of similar plant before the war.

"A committee was appointed by the Minister of Works in December, 1945, to review the price structure of the cement industry. This committee has made a detailed factual examination and has now reported to the Minister. I understand that its report is likely to be published in the next few weeks. The cement industry welcomed wholeheartedly the appointment of the committee and is anxious as anyone that its report should be published. I, for one, am proud of the industry's record since it seriously took in hand the work of organizing itself in 1934. It did a good job before the war and a good job during the war. All it asks now is to be left alone to carry on its work in the post-war period, unhampered by ill-informed criticism. To those of us who believe in freedom it is a matter of satisfaction that the cement industry is to be withdrawn from the scope of the Essential Works Order, on 30th April, 1947.

"Owing partly to the necessity for economizing in the consumption of coal and partly to a probable shortage of packages later in the year, the Government instructed the industry to restrict exports during the first three months of the year. I am glad to say that some relaxation has been found possible and I am hopeful that our export trade will continue to make a useful contribution to our profits. The question of packages is now well on the way toward solution, though I fear that it will mean an additional cost to the consumer a little later on until an adequate supply of paper sacks is again forthcoming."

Safe Driving Wins Awards For 19 Permanente Drivers

Nineteen drivers of Permanente Cement Company recently received awards and identification cards at a dinner in San Jose, Calif., for driving more than

• Tony Ferraro receiving his award.

1,512,000 miles in 1946 without a preventable accident. Sergeant Paul Perussina of California State Highway Patrol presented the safe driving awards. Tony Ferraro (see illustration) has driven approximately 400,000 miles in the past five years without an accident.

The Roach Sand & Gravel Company at St. Francis, Kan., was recently sold by Tom Roach to Kenneth Nighswonger. Mr. Roach was forced to relinquish the operation of the business because of ill health.

Lone Star Improvements Reported in U. S. and Latin American Countries

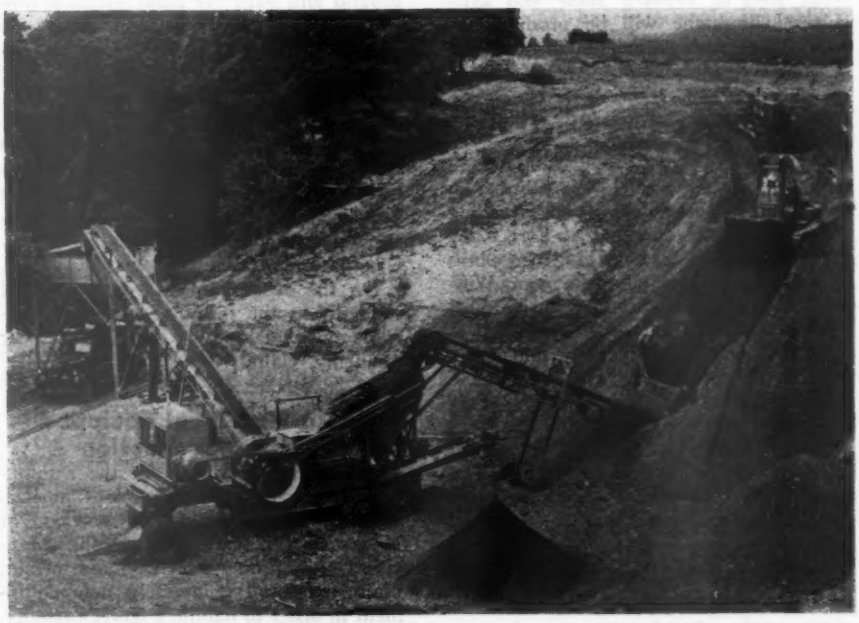
Several major projects recently completed by the Lone Star Cement Corporation in its current expansion program have been reported as follows: New packhouses and equipment at Greencastle, Birmingham and Dallas; additional silos at Birmingham and Dallas; new coolers at Norfolk; an ocean-going tug — the *Charles L. Hogan* — for the New Orleans marine department; a new reinforced concrete office building at Bethlehem; a new storeroom and machine shop at Mariel, Cuba, to replace the buildings destroyed there by fire in 1944.

As for Latin-American Lone Star operations, the demand for cement in Cuba continued to exceed the available supply in spite of the recently-completed fourth kiln. A fifth kiln will be installed in Cuba this year if materials can be obtained.

In Brazil, Argentina and Uruguay the demand also continued high. An additional kiln is to be installed at the Brazilian plant (Guaxindiba); but because of slow deliveries of parts no relief can be anticipated this year.

Historic Quarry Reopened After 33-Year Interlude

After lying idle for 33 years the quarry at the site of the old Harris Lime Company, Lincoln, R. I., is again being worked. Emphasis is now placed upon the production of agricultural limestone, rather than building lime, for which the area was once a plentiful source. Already many tons of limestone have been blasted from the ledge of the quarry.



• At Washington, Ill., a "Caterpillar" diesel D13000 engine on a Gruendler conical roll portable gravel plant produces 700 cubic yards of gravel in 8 hours, using approximately 26 gallons of fuel. A "Caterpillar" diesel D4 tractor with a Traxcavator supplies all the gravel to the plant. For stripping operations a "Caterpillar" diesel RD6 tractor is used, moving approximately 600 cubic yards of overburden every eight hours.

Nonmetals Freight Loads Expected to Increase In April-June Period

Freight car loadings of cement in the second quarter of the current year are expected to be 9.6 percent above those in the corresponding period of 1946, according to estimates compiled by the 13 regional Shippers Advisory Boards and made public by the Association of American Railroads.

On the basis of those estimates, freight car loadings of cement will total 194,456 in the second quarter of 1947, as compared with 177,370 actual car loadings in the corresponding quarter of last year.

Car loadings of gravel, sand and stone will increase 11.8 during the same period, from 475,409 to 531,329, according to the estimates. An increase of 19.9 percent was forecast for carloadings of brick and clay products, which are expected to jump from 59,023 in the second quarter last year to 70,796 this year.

The estimates predict an increase of 10.4 percent in car loadings of lime and plaster, with the total reaching 40,182 during the second quarter of the current year, as compared with 36,413 in the same period a year ago.

Muncie Stone & Lime Company Acquired by Albany Concern

The M. D. & R. Stone Co., Inc., of Albany, Ind., has announced the acquisition of the Muncie Stone and Lime Co., of Muncie, Ind. The officers of M. D. & R. Stone Co., Inc., are A. F. Dunkin, president, Albany, Ind.; Bert J. Runyon, vice-president; Ridgeville, Ind.; J. J. Murname, secretary, Dunkirk, Ind.; and D. J. Murnane, treasurer, Dunkirk, Ind. They will hold the same offices in both companies.

All sizes of crushed stone and agricultural limestone will be produced at both plants, with A. F. Dunkin in charge of sales and equipment.

Kansas Firm Moves Plant From Ft. Riley to Winfield

W. O. Homer and J. W. Storms Jr. have purchased the big rock crushing plant which was operated at Fort Riley during World War II. The firm plans to move the plant to a site near Winfield, Kan., and to produce agricultural lime in addition to crushed rock.

L. E. Jaecke, who recently joined the firm, is superintendent. He directed the dismantling of the facilities at Fort Riley and the erection of the plant at Winfield, which is expected to be in operation in the immediate future. The anticipated capacity of the new plant is about 60 tons per hour.

Ideal Cement Signs Lease For Mobile Shipping Rights

By the terms of a transaction recently closed by the Ideal Cement Company of Denver, Colo., with the Alabama State Docks Commission, the state will receive a guaranteed sum of $20,000 annually for the use of dock facilities at Mobile.

The lease states that Ideal will pay the commission 10 cents a net ton on all raw materials shipped to the plant by water.

Dust-Collecting Industry Loses a Leader—Mike Eiben

We regret that it was impossible last month to secure a photograph and enough information for an appropriate announcement of the passing of M. A.

M. A. Eiben

(Mike) Eiben, president of the Northern Blower Company of Cleveland, O.

Mr. Eiben started his business career at the age of 16 years, when he began to work as a tinner, installing dust collecting systems, chiefly in the wood-working industry. In 1911 he purchased some ground and built the plant which is now the Northern Blower Company at its present location. (The company was incorporated under the statutes of Ohio in 1941 under its present name.)

About this time Mr. Eiben began traveling throughout the United States to gather information on dust-collecting installations in the crushed stone and cement industries. Later he also inspected installations in Mexico, Cuba, Canada and Alaska.

On the evening of March 7 he died suddenly as the result of a heart attack while visiting one of his mines near Academy, Calif.

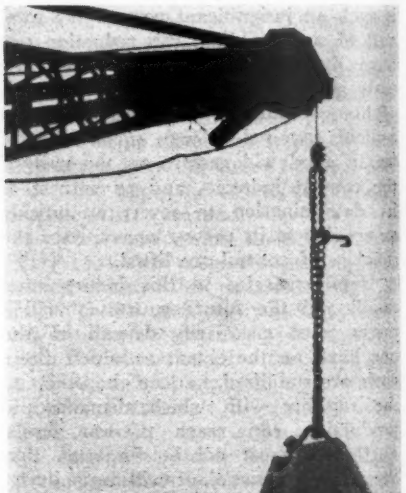
DeSousa Slag Plant Equipped For Increased Production

Plans are under way for the resumption of the DeSousa slag plant at Reiglesville, Pa., which during World War II was under lease to the Johns-Manville Corporation. John DeSousa, owner, plans to install completely new equipment in order to handle a larger capacity.

Operations are expected to begin this spring. By-products of the plant will be sold as pea gravel and ballast. William E. Robinson, consultant designer, prepared the plans for the new installations.

Chain Eliminates Twist And Kinkage in Drop Hammer Rope Cable

Operators who use "skull-crackers" or "nigger-heads" to break paving, rock, scrap, slag or other material know the common trouble with the hoist rope is not so much the shock and torque attendant to lifting and dropping the hammer as the tendency of the wire rope to twist and kink when suddenly released of all tension as the hammer hits the material. Invariably the momentum of the hoist line makes it continue its travel six or eight feet after the impact of the skull-cracker, and this slack permits it to twist or even kink. Much of this difficulty can be overcome by the use of preformed wire rope because the preforming process frees the component wires from locked-up torsional stresses, thereby greatly reducing the tendency of non-performed wire rope to twist, rotate or kink. The accompanying illustration shows how one operator eliminated wire rope twist completely by using ordinary welded chain as the rope terminal. The chain takes the sudden slack without twisting and so holds the line steady, free of all tendency to twist or kink.



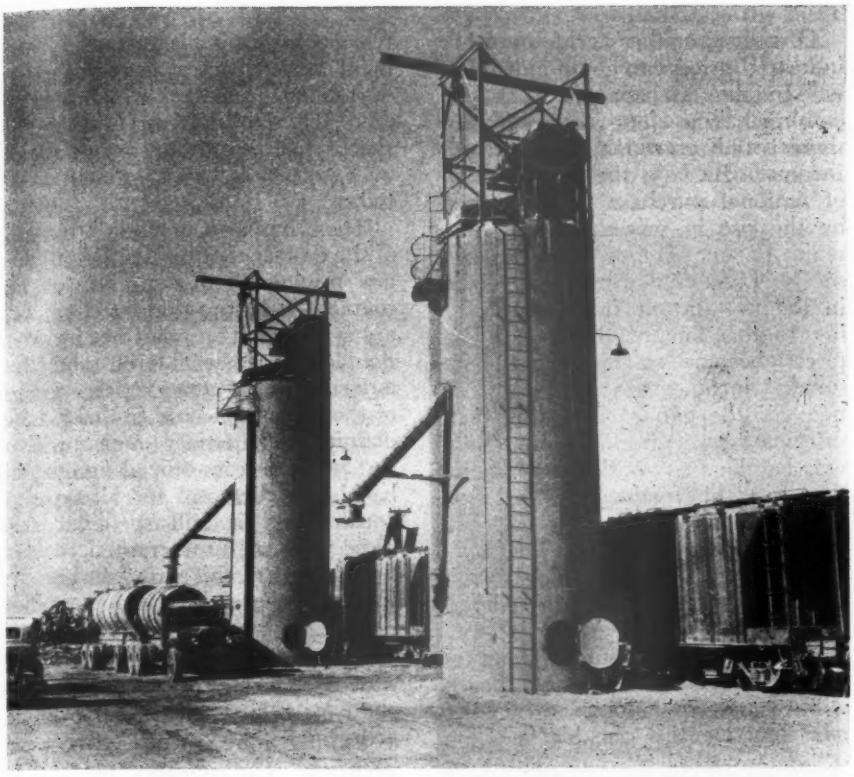
• Chain replacing rope terminal.

Liberty Ships to Carry Phosphate to Orient

Over a half million tons of rock phosphate bound for ports in Japan and Korea will be shipped through the Port of Olympia, Wash., during the first six months of 1947. The gravel-like phosphate, which comes from strip mining operations in Idaho and Montana, will be converted to fertilizer in the Orient as a part of the program to increase food production there. It will be hauled to the port in some 12,000 railroad cars.

It is estimated that about 70 Liberty ship crossings will be required to move the rock from the West Coast to the Orient.

Bulk Cement Transfer Plant Erected at Azusa, California



• The new transfer plant of the Southwestern Portland Cement Company at Azusa, Calif. Covered hopper cars on the track bring cement from the Victorville plant. Note the delivery truck-trailer being loaded.

another ON THE SPOT report

TO keep pace with the growing demand for truck-delivered bulk cement, particularly among concrete-products and ready-mixed concrete operators, the Southwestern Portland Cement Co. of Los Angeles recently placed a new transfer plant in service at Azusa, Calif. This is the second plant of this type to be erected by Southwestern, the first, located at Hynes, Calif., having been in service for many months.

The new Azusa plant includes two steel silos, each of 450 bbl. capacity. Located on the Reliance Spur of the Santa Fe railroad, the cement is received, either in covered hopper or box cars, from the company's plant at Victorville, Calif. The hopper cars discharge directly into the track hoppers which feed the silos via screw conveyors and bucket elevators. Box cars are unloaded into the hoppers with portable "cement hogs".

At the top of the towers, single-deck vibrating screens sift the cement and remove any trash before the cement enters the truck-loading silos. Bindicators actuate signal horns to warn the operator that the silos are nearly full.

The company operates a fleet of seven bulk-cement trucks and truck-trailer units with capacities of 100 and 120 tons, respectively. These are spout-loaded directly from the silos and may be filled at either the Azusa or Hynes plants.

Robert E. Snow is in charge of the new Azusa plant which went into operation about the first of the year. In 1946, before the storage silos were erected at Azusa, trucks were temporarily loaded with cement hogs direct from cars spotted on the spur track.

The Azusa plant was built and erected by The Conveyor Co. of Los Angeles.

Bureau of Mines Releases Report on Diamond Drilling

Diamond-drilling techniques employed in the preparation of blast holes at a large eastern magnetite development are described in a publication released by the U. S. Bureau of Mines.

Written by McHenry Mosier, Chief of the College Park (Md.) Division of the bureau's mining branch, the publication is the first of a series designed to describe current practices in diamond drilling for production purposes throughout the United States, and to discuss the relative merits of this method as compared with percussion drilling.

Principal advantages of diamond drilling blast holes at the mine in question, the publication states, include safer working conditions in open stopes, recovery of additional ore, a reduction in the amount of stope development, a continuous maximum production from stopes, and virtual elimination of dust from drilling. On the other hand, the disadvantages are the need for greater capital investment and the employment of highly skilled personnel to load and detonate the charge in long holes. A free copy of Information Circular 7393, *Diamond Drilling Blast Holes, Easter Magnetic Mine A,* may be obtained by applying to the Bureau of Mines, Department of the Interior, Washington 25, D. C.

Safety, Good Will Fostered By Installation of Elevator

Worker - management relations have been immeasurably improved in the Willow Grove Mine No. 10 of the Hanna Coal Company, St. Clairsville, O. With the installation of a new high-speed Otis elevator, the company completed the first step toward the general modernization of employee facilities. The 3,500-pound elevator provides an additional escape point from which the miners can get out of the 172-foot shaft in 22 seconds.

In the new portal building atop the elevator shaft are a 25-shower washroom and dressing room, modern toilet facilities, a lounging room, and a restaurant which serves hot meals for all three shifts. Ultra-violet lamps have been installed to minimize the dangers of spreading airborne germs of colds and other illnesses.

Kaiser Employees Insured In Company-Shared Plan

Life insurance valued at more than $25,000,000 has been made available to about 11,000 employees of the Henry J. Kaiser Company and associated concerns. The firms will pay premiums for employees having at least five-year service records and a substantial part of the expenses on policies for those more recently employed.

Dewey Plant at Davenport Wins Safety Council Award

Because of a record of operating more than 1,500,000 man-hours without a disabling injury, the Dewey Cement Company's plant at Davenport, Ia., has been awarded the National Safety Council's Distinguished Service to Safety award. The award has gone to only seven cement plants up to the present time.

The Leander Limestone Corporation at Leander, Tex., third new quarry operation to be launched recently in this area, is currently shipping its product from the plant. Officers include the following: R. K. Allen, president; Lois F. Giddens, vice-president; J. W. Hanson, secretary-treasurer.

WASHINGTON NEWS LETTER

another P and Q exclusive

IN the last few months the President and his advisors have made repeated statements to the effect that prices are too high and must be reduced if an economic recession is to be averted. So far these appeals seem to have had very little effect. Instead of coming down, the cost of living, paced by sharp jumps in food prices, is still on the way up. And with real government authority in the form of price control no longer on the scene, it is becoming clear that no matter how eloquent a case is made by the administration on moral grounds, prices will stay high, and possibly even increase, so long as inflationary forces continue to dominate the economy.

To set the problem in proper perspective, it is important to remember that the sharpest price increases, both before and after the lifting of controls, have taken place in agricultural commodities. At the present time these commodities are priced, on the average, almost three times as high as before the war. Since the middle of last year, when the price control program started to totter, farm product prices have shot up more than a third. The prices of industrial goods of all kinds have increased sharply, too, although on the whole the gain has been much less than for farm commodities.

The point here is that regardless of the effectiveness or ineffectivenesses of pleas to business leaders to cut prices, the biggest item in the family budget—food—will remain substantially unaffected, for farmers can hardly be expected to sell their crops for less than the market will bring. In addition to a huge domestic demand, farm prices find supplementary support from the high level of foreign demand. Agriculture abroad is still not fully recovered from the effects of the war, and present indications are that this year's harvest in many countries will be below even the relatively low level of output expected. It is very doubtful that the fact that the last few years have been comparatively fat ones will carry any more weight with farmers than with industrialists. The memory of the lean years that went before are still too vivid, and there is still plenty of fear that lean years may be ahead.

Of course, neither agricultural nor industrial prices can go up indefinitely. In the last analysis, it is the consumer who foots the bill and there is only so much stretch to his income. In fact, the deterioration of national purchase power caused by the rise in prices has been the main theme of those experts predicting a recession of business activity in the not distant future. According to this line of thinking, when prices become so high that consumers' incomes are insufficient to take all the goods off the market, prices of agricultural commodities will be the first to decline because they are the furthest out of line. This lack of balance does not give any clue as to just when the break in prices will occur, nor how rough or precipitate the tumble will be when it does come. What is more important—even granting what is by no means certain, that farm prices will turn sharply downward in the next few months—the big question still unanswered is what pattern of events will follow. Specifically, *must* a drop in prices be accompanied by a drop in production and employment as well, or might it simply mean a continuation of present prosperity at a somewhat lower general price level?

This is obviously the key question in evaluating the seriousness of the economic outlook. In answering it, many Washington economists tend to be influenced to a large extent, as is their wont, by the record of the past. They point out that never before has a major downward adjustment of prices been accomplished without a substantial decline in the physical volume of output in the economy as a whole. Therefore, this school of thought insists, to speak of a price readjustment without a concomitant fall of production and employment is to flout all history.

The experience most frequently cited in this connection is the 1920-1921 collapse, when prices at wholesale fell almost 50 percent in a year, industrial production dropped by almost one-fourth, and the unemployment rolls expanded by four million. However, without going into a detailed analysis of the similarities and dissimilarities between the two booms, it is clear from government reports that at least one major unstabilizing element which accelerated the World War I decline—speculative inventory accumulation by business—is hardly present at all today.

There has been much talk recently of the danger that residential builders are pricing themselves out of the market. It is true that building costs are approaching a point not far from double the prewar level, and that a decline in the construction segment of the economy would probably have definite deflationary repercussions. But judging from official figures, the backlog of demand for all types of construction is still so great that these fears are unwarranted, at least for the rest of this year. At present, for example, only about a million new housing units are scheduled for completion in 1947. This compares with a backlog of needs of some eight, ten or twelve million units, as estimated by various government agencies. The number of families requiring and seeking housing has received a tremendous impetus in the last few years as a result of the huge increase in marriages and births. Even if the majority of these families are unable to buy or rent new housing at present prices, there seems to be more than enough demand, backed up by willingness and ability to pay, to absorb at least the entire million units. In fact, the real danger is not so much a dearth of takers as that materials and labor will be insufficient to produce the entire million. Competition for these resources is keen from commercial and industrial construction, for which there is still a large backlog of deferred demand.

Demand for housing and for goods and services in general has been considerably strengthened by the current round of wage increases. The result may well be to keep the inflationary fires burning, though not for the reasons usually suggested. These increases may not be passed on to the consumer directly; but higher wage incomes, by augmenting public buying power, should serve as a powerful prop to total demand and should help check any general downward price trend which develops.

MEN OF THE INDUSTRY - CHARLES WARNER HEADS BIG LIME PRODUCING FIRM

Active in Promoting Industrial Cooperation As N.L.A. President

LIME is an important industry in the United States, and one of the most important and interesting men in the lime industry is Charles Warner, one of the pioneers who helped make lime the $50,000,000 business it is today.

Charles Warner is president of the Warner Company, Philadelphia, one of the largest lime producers in the United States. The fact that this organization is also important in the sand and gravel, ready-mixed concrete and crushed stone fields is indicative of Mr. Warner's organizational talents and foresight.

During the past five years the lime industry has been taxed to its fullest capacity to supply wartime demands, but the Warner Company, ably guided by Charles Warner, managed to meet these demands and supply the many industries that used lime in their war production work. Probably it is worth while to name some of these industries—such as iron and steel, magnesium, leather, paper, carbide, glue, gelatin, refractories, synthetic rubber, glass, oil, sugar, salt, photographic supplies, fire extinguishers, coal mining, insecticides, paint, public utilities, water treatment plants, and sewage disposal plants. It is also to be remembered that the Warner Company is one of the few companies that produce both high-calcium and high-magnesium lime.

The company's interest in the lime industry dates back to 1900, when the then Charles Warner Company purchased a half interest in the Cedar Hollow Lime Company.

The first hydrated lime plant east of Ohio was built at Cedar Hollow in 1901. In rapid succession during the next ten years, other plants were purchased, including full ownership of Cedar Hollow, Whiteland, McCoy and Keystone. During this period, Charles Warner, aided by Irving Warner, now with the Warner Company as vice-president in charge of engineering and purchasing, made many major contributions to the development of the industry, in the way of increased productive capacity and efficiency. By 1915, when construction of the modern Warner plant at Cedar Hollow was started, the Warner Company was the largest producer of dolomitic lime east of Ohio.

In 1921, a contract, including certain optional purchase rights, was negotiated to undertake the management of the high-calcium lime

Charles Warner

plants of the American Lime and Stone Company, with main offices and plant located at Bellefonte, Pa. Here, under Warner management, was pioneered the underground mining of limestone, and the production and marketing of rotary-kiln lime, which has since become so important in the lime industry.

By purchase, Warner gradually acquired the outstanding stock of the American company, and in 1936 this company was a fully-owned subsidiary. It was dissolved to become the Bellefonte Division of the Warner Company in 1944. Other plants were acquired through the years, and while the plants themselves were shut down as uneconomical to operate, their quarries now provide the Cedar Hollow and McCoy plants with an almost inexhaustible supply of high-quality dolomitic limestone.

It is interesting to note that as far back as 1918 a patent was awarded to Charles and Irving Warner, covering the hydration of dolomitic lime under pressure. While apparently of no economic value at the time, it is this same process that is now used to produce the modern masonry hydrated limes.

Charles Warner did not content himself with production problems alone; from the beginning he was acutely conscious of the necessity for, and the value of, industrial cooperation. Not only was he one of the organizers of the first National Lime Association in 1902, but he served actively as president and a member of the board of directors for a great many years. Only a year ago Mr. Warner was named by the Construction Industry Advisory Council as a member of the liaison committee appointed to work with the government in stimulating post-war construction.

In 1910 the Charles Warner Company sponsored the Hydrated Lime Bureau, an organization of producers designed to promote the use of hydrated lime in construction and agriculture. Largely through this bureau and its successors, hydrated lime assumed a major position in the masonry mortar field. A successor organization, the Quality Lime Institute, has been functioning since 1925 without interruption.

Mr. Warner says that his most delightful reminiscences have to do with his pleasant associations with the men in the early lime industry, and the part they all played in those days in building up the National Lime Association. In addition to his duties as president of the Warner Company, Mr. Warner is also a director of the Atlas Powder Company of Wilmington, of the North American Cement Co., of the Federal Home Loan Bank of Pittsburgh, and of the Philadelphia Chamber of Commerce and Board of Trade. Mr. Warner states that his present hobbies are his work, his grandchildren and great grandchildren.

Bright Future Predicted for Sweden's Synthetic Gypsum

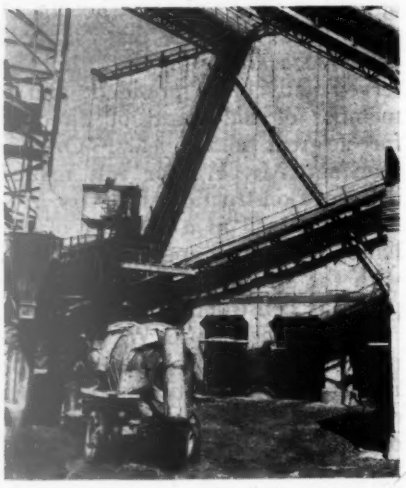
The scarcity of gypsum in Sweden during World War II was partly alleviated by the synthetic production of gypsum from lime and sulphuric acid. High calcium lime is abundant in Sweden, and the acid was obtained as a waste product from the manufacture of T.N.T. The synthetic gypsum is of high purity and is used for surgical, industrial and chemical purposes. This process is expected to have post-war industrial possibilities.

SMOOT BATCHES GRAVEL AND CEMENT TO WASHINGTON R.M.C. PRODUCERS' TRUCKS

another ON THE SPOT report

IN Washington, D. C., the never-never land beyond the mirror, even normal business and industrial pursuits not directly associated with the frenized acrobatics on Capitol Hill are likely to differ strikingly from similar activities in other cities. Whether or not such differences are uniquely due to the environment, the net effect in some instances can be most beneficial, as in the case of

By WILLIAM M. AVERY



a unique arrangement which has prevailed for many years in the local ready-mixed concrete industry.

When ready-mixed concrete first made its appearance in the Capitol many years ago, the Smoot Sand & Gravel Corporation, largest producer of aggregates in the District, appraised its possibilities carefully and found them good. Recognizing the new industry's potentialities as a future consumer of large quantities of sand and gravel, the company established batching plant facilities on its own properties and engaged to sell batched materials at the same price that applied to materials in bulk. At the same time there was adopted a strict policy of remaining completely out of direct activity in the ready-mixed-concrete business in order to avoid competing with the company's own customers.

The idea caught on quickly. Ready-mixed producers were glad to be relieved of the large capital outlay required to establish their own batching plants, and were only too happy to pass the related operating and maintenance problems on to the aggregates producer. Since its inception the plan has been operated and developed to render the maximum service to customers, and the Smoot company has adhered strictly to its original intention not to operate ready-mixed-concrete trucks of its own.

When technological developments in the industry had clearly indicated the superiority of weigh batching over volume batching, the company in 1927 set up an experimental weigh-batching plant to demonstrate to its customers the advantages of the new methods. For a while some central mixing was done in compliance with demand, but in general the operations have been on a dry-batch basis, with the materials being weighed into the customers' transit-mix trucks.

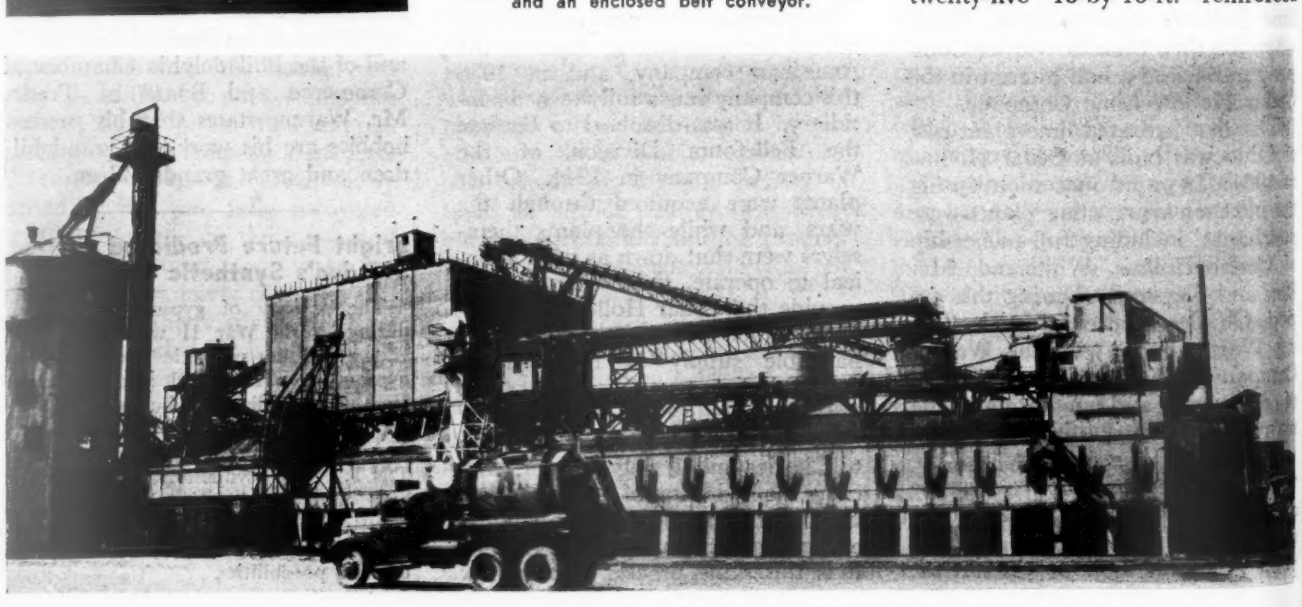
Charges are made solely on the basis of the amounts of materials actually discharged into the trucks, and the company assumes no control over, or responsibility for, the design of mixes. Truck drivers present at the batching plant written orders calling for definite weights of specified materials, and the Smoot company's sole responsibility is to see to it that the orders are properly filled.

In all, three batching plants are operated in Washington proper on the Potomac River. At the K Street plant, largest of the three, there are twenty-five 16-by-16-ft. reinforced

• Top: Entrance end of the five-aisle batching bins at the Smoot Sand & Gravel Company's plant, Washington, D. C. There are 25 bins, each holding 500 cubic yards of materials.

• Left: A 4-cu.-yd. truck mixer loading under the batching bins.

• Below: A general view of the K Street plant. The bins in the foreground are for bulk loading only. The three 3,000-bbl. cement bins are fed by the bucket elevator and an enclosed belt conveyor.

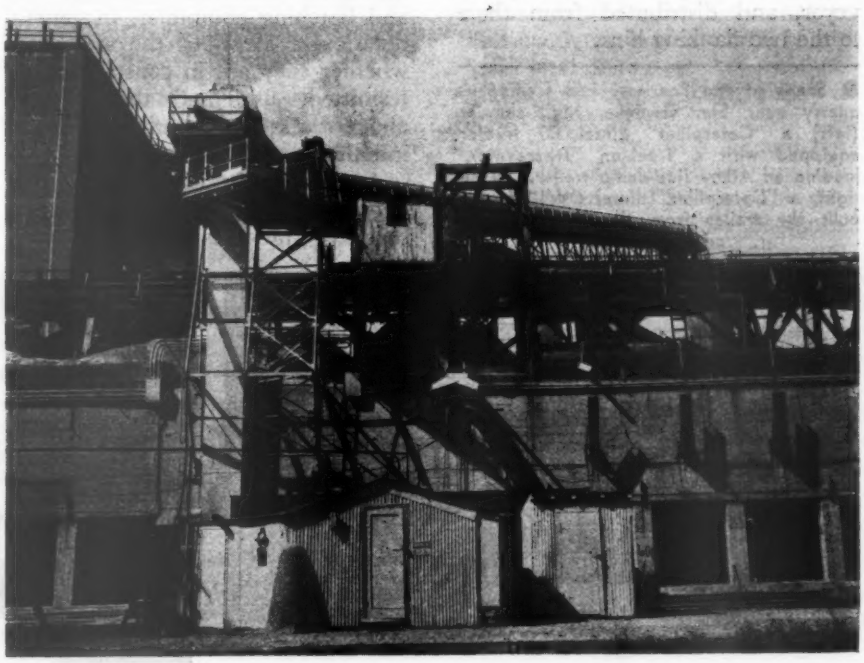


concrete bins, each holding 500 cubic yards of aggregate. The bins straddle five parallel aisles or roadways, making it possible, when necessary, to load several trucks simultaneously. When the pressure is on, the K Street plant has frequently loaded trucks at the astonishing rate of one a minute, and has maintained this pace for as long as necessary. In 1942, during the peak of war construction, this huge capacity enabled the company to furnish over 2,000,000 cubic yards of material to ready-mix operators and contractors.

Blaw-Knox batchers equipped with Fairbanks scales are used exclusively at the K Street plant. The batching equipment is suspended beneath the bins in the conventional manner, and the operators handle the controls from platforms located between the truck aisles. Since the bins were built it has been necessary to raise the batching hoppers several times in order to maintain adequate headroom for the increasingly large trucks used in ready-mix operations. To carry the immense loads involved, the K Street bins rest on sizable caissons which go down 40 feet to bed rock.

The extraordinarily large number of bins is necessitated by the variety and range of the specifications which must be met by ready-mixed-concrete producers in the District of Columbia. On concrete alone about 30 different specifications are encountered, and the K Street plant was set up to furnish material for any of them on short notice. Currently about nine sizes of material are kept on hand, and the company is prepared to furnish virtually any blend that the customer could possibly require. Some 30 different commercial grades of material are marketed in addition to the wide range of concrete specifications which are met.

The company furnishes accommodations at the plant for constant inspection service when it is required under Federal and District of Columbia specifications. In such cases the government provides its own inspectors and testing equipment to determine the gradation and the water content of all materials fur-



• Top: The belt conveyors elevate the materials to the top of the battery of batching bins.

• Center: The exit end of the batching line. The transit-mix truck in the foreground has just pulled out from under the cement bins. The timber bins on the right, built in 1929, are now obsolete, except for reserve capacity for bulk sales.

• Right: Another view of the bucket elevator and the enclosed belt conveyor which feed cement from the under-track hopper to the bins.

● Left: The batchers are suspended under the bins in the conventional manner. Operators work on platforms between the parallel truck aisles.
● Right: A 4-cu.-yd. mixer taking on cement and water.

nished. The Smoot company runs its own preliminary tests on the six dredges which it operates. Steam-heated materials and hot water are furnished during the winter months.

There are three Blaw-Knox cement bins at the main plant, each divided into four 750-bbl. compartments. They straddle a 2-lane roadway into which the trucks swing when they pull out from under the aggregate bins. A complete range of the various types of cements in demand is kept on hand at all times, and the large total storage capacity (9,000 barrels) enables the company to supply all reasonable demands. Cement is discharged at the center bin by means of a bucket elevator and an enclosed Link-Belt belt conveyor, and distributed from there to the two flanking bins.

The batching service is in almost constant use by four ready-mixed concrete concerns, one operator who rents trucks, and a number of contractors who operate their own transit-mix equipment. For large projects at considerable distances from Washington, the Smoot company sets up on or near the site a complete rehandling plant supplied by truck shipments in bulk.

Although the company's dredges are equipped to produce specification material if necessary, all gravel is rewashed, rescreened and crushed at the K Street plant before it is stored in the bins. The dredges operate in the Potomac River within approximately 10 miles of the plant.

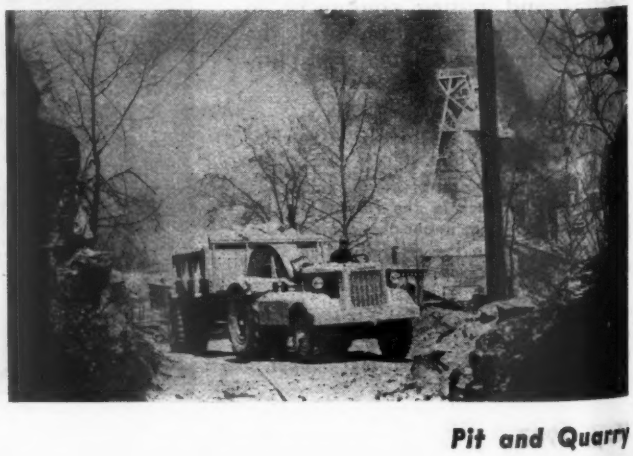
The successful operation of the Smoot batching service over a period of many years suggests that the plan might be applicable in other large cities or in industrial areas where several ready-mixed-concrete producers are established. Storage bins and batching equipment in general deteriorate at about the same rate whether they are in constant or intermittent use, and they require about the same operating personnel in either event.

Apart from considerations of economy and efficiency, the availability batching facilities such as those maintained by the Smoot company makes it possible for a relatively small ready-mix operator to bid successfully on tough specification jobs which would be clear beyond the capacity of any equipment which he would likely to set up in his own plant. In addition, it enables the operator to render the maximum service to his own customers, since he can furnish on short notice a mix involving almost any conceivable blend of materials.

Officers of the Smoot Sand & Gravel Company are L. E. Smoot, president; A. M. Parker, secretary; T. A. Butt, treasurer; Ralph V. Driver, purchasing agent and J. Alexander Woodward, engineer. The company operates six dredges on the Potomac River.

● Scene at the Peerless Lime Company's quarry near Ste. Genieve, Mo., showing (left) a "Caterpillar" diesel D7 tractor, equipped with a Trackson "Traxcavator," loading an Athey side-dump trailer. At the right, a "Caterpillar" diesel DW10 tractor pulls the trailer from the quarry to the crushing plant.

Mineral resources of Wyoming, exclusive of coal and oil deposits, have an unmined value of $1,297,750,000, according to an estimate of the Wyoming Natural Resources Research Institute at Laramie. They include 10,000,000 tons of asbestos with a valuation of $2,500,000 in the ground, $50,000,000 mined value and $200,000,000 retail or manufactured value; and 160,000,000 tons of mica, with a manufactured valuation of $15,000,000.



THE USE OF BURNED LIME PRODUCTS IN SOIL IMPROVEMENT

By J. W. WHITE
Pennsylvania Agricultural Experiment Station

IN the late summer of 1905 a Methodist church was nearing completion on a lot back of my home in a small eastern Carolina town, Greenville, North Carolina, that is. A pit five feet deep and ten feet in diameter dug into the sandy soil had been filled to the ground level with "cream of lime" in preparation for finishing the plastered walls. On this memorable day in question I was making my usual hurried short-cut to the post office, preoccupied with the anticipation of a letter from my one and only one. To make a long story short, I ran directly into this lime pit and settled down rapidly until my feet touched bottom, the thick cream of lime reaching the base of my 3-inch collar. For once in my life I was justified in sticking my neck out. While floundering around in an effort to reach shore I thought of my precious and only collegiate outfit—new tan shoes, a blue chambray shirt, white flannel trousers and a small bow tie. The wide-brimmed, fancy-banded straw hat, the only visible part of my Beau Brummel outfit, lay half filled with oozy lime, just beyond my reach. I don't know how I finally managed to extricate myself but I have reason to believe that I did. What my family said and did when I appeared before them, like the Hamlet's ghost, is a long and embarrassing story, and I shall leave further details to your imagination.

You will agree, I am sure, that even at an early age your author became more closely associated with lime than anyone before or since that time. Furthermore, he holds the world's record, and this is written unblushingly, in that he got completely plastered in less than ten seconds, and on church property at that. Yes, burned lime products work fast.

This baptism in lime was destined to have a far greater significance than merely the loss of my only collegiate outfit. Within three weeks following my dunking experience I received a letter from the late William Frear notifying me of my appointment as assistant chemist at the Pennsylvania Station. My association with him, a pioneer in lime research, and with the late Alva Agee, author of several books on agriculture including one on *The Right Use of Lime in Soil Improvement,* soon led me into the field of lime research which I have followed since that time. Maybe my Presbyterian friends are right in their belief in predestination.

J. W. White

The purpose of this paper, therefore, is to present some of the more outstanding results secured from our lime research studies at the Pennsylvania Agricultural Experiment Station. Before presenting the nature of our lime research program and some of the more practical results secured, it seems desirable to review briefly the development of our agricultural lime market as a background.

Development of the Agricultural Lime Market

In one of his papers on *Chemistry of Old Boston,* Dr. Lyman C. Newell, Professor of Chemistry, Boston University, wrote as follows: "The colonists were familiar with the English method of manufacturing lime by heating limestone, and doubtless they prospected for limestone as they did for gold, lead, medical plants, etc. Hence there was great rejoicing and considerable excitement when limestone was discovered in 1697 in Newbury, Mass., by Ensign James Noyes. The news of the discovery spread, and it is said that at first thirty teams a day came to Newbury to drag away the 'precious stone.' The few inhabitants were startled by the removal of their riches, and sent James Brown, the deputy sheriff, to stop the spoilation."

According to Dr. Newell, lime was manufactured from limestone as early as 1661 in Providence, R. I., and sent in large quantities to Boston. This date, no doubt, (286 years ago) marks the beginning of commercial lime production in America.

A report from New Amsterdam, written in 1685, stated as follows: "There is no limestone as yet we know of, but we make lime of oyster shells which by the sea and bayside are plentiful. We may load ship with them." In 1703 the New York Assembly passed a law prohibiting the distilling of rum and the burning of oyster shells into lime within the City of New York. (From Lyman Carrier's book, "The Beginning of Agriculture in America.")

Discovery of Limestone in Pennsylvania

The absence of limestone along the Atlantic coast worked hardships on the colonists as it was needed as a source of lime both for agriculture and commerce. The beds and heaps of oyster shells left by the Indians, together with a limited supply of marl, served as a substitute in part for the yet-undiscovered limestone deposits which lay in abundance west of the early colonial settlement.

On October 1, 1754, William Logan, whose farm was near Philadelphia, recorded having put 50 bushels of stone lime (burnt limestone) in small heaps to an acre. It is of historical interest to note that the limestone from which the burnt lime was prepared was quarried near Mt. Joy, Lancaster County, in 1754 and represents the first limestone quarried in Pennsylvania. Thus does this date (193 years ago) mark the beginning of the use of the inexhaustible supply of limestone resources of the Keystone state, which from that date has led in limestone production.

In 1810, Richard Peters, then president of the Philadelphia Society for Promoting Agriculture (founded in 1785), gave what may be considered the first comprehensive address on liming land. He was owner of the famous Belmont Farms, now a part of Fairmount Park, Philadelphia. "When I began to lime 45 years ago," (1765) he stated, "I had no practical instructor for it was a

• Below: Slaking lump lime from the farm kiln. Geologists say that limestone valleys in Pennsylvania may be 6,000 feet deep. Small wonder that Pennsylvania leads in Limestone production.

• Spreading commercial hydrated lime in preparation for wheat seeding. A bushel of hydrated lime weighs 21 pounds, as compared with 90 pounds of limestone; hence it is more economical.

novelty in my neighborhood. . . . I have had kilns of lime burnt on my Belmont farm (which is on the tide-water of the Schuylkill) from limestone brought down the river, through the great falls, in a boat carrying 12 to 14 tons. . . . Enterprising persons," he stated, "might establish on a large scale plans of this kind. Since this communication I am informed that a plan for burning lime on the tide-water of the Schuylkill is commenced. It has my sincere wishes for its success." By 1820 this new enterprise became of commercial importance. Thus did Richard Peters, in 1765 (182 years ago), pave the way for the extensive commercial production of burned lime products.

It is of interest to note that the limestone brought down the Schuylkill was quarried near the site of the Charles Warner Cedar Hollow operations in Chester County, Pa.

Following the period of colonial expansion westward, many farm lime kilns were put into operation throughout the limestone valleys of Pennsylvania. These farm kilns later were extended through the southern half of the state to the Ohio border. Today, 193 years since the first kiln for burning limestone was built by William Logan in 1754, many farmers of Pennsylvania and nearby states still use burned lime products largely to the exclusion of other forms of agricultural lime.

No greater tribute could be paid burned lime products than this—for a period of two centuries they have been a major factor in the development and maintenance of a permanent agriculture in southeastern Pennsylvania, especially in Lancaster County, the "Garden Spot of America." This county has maintained an average crop productivity index over twice that of the state average. In Earl Township the crop productivity index is 337 and the index of farm returns per acre of farmland is 530, compared with 100 for the state average.

The rapid development of our agricultural lime market may be illustrated from the fact that from 1929 to 1945 inclusive the total tonnage of all forms of lime sold for soil treatment increased from 3,807,852 to 23,023,104 tons in terms of the limestone equivalent. (Report of Production and Marketing Administration, U.S.D.A.)

Relative Amounts of Limestone and Burned Lime Products Used in Different Regions, 1945 Based on Total of Each Used in U. S. = 100

	North Eastern	East Central	North Central	South	West
Number of States	9	7	8	9	4
Limestone	19	16	63	7	3
Burned lime products	42	44	7	1	6

(Compiled from 1945 Lime Report of the National Lime Association.)

From this summary it is seen that the Eastern states used the major portion of burned lime products for soil improvement. There is an underlying reason for the discrimination against burned lime products in the North Central states (Mid-West) beyond that of lime economy.

Lime "Impropaganda"

When pulverized limestone became a competitor on the agricultural lime market about 1909, a period of keen competition arose which led to exaggerated claims by the producers concerning the merits of their respective products. The pamphlets issued by both sides denouncing the other fellow's goods and ignoring the opinions of our Agricultural Experiment Station led to considerable confusion in the minds of the farmers concerning the values of the different forms of lime. It was here that your author entered the picture in an effort to discourage this unfair competition until definite information (then sadly missing) could be secured.

The most serious and unfair propaganda was that concerning the effect of burned lime on the destruction of soil nitrogen and organic matter. After the Jordan Soil Fertility Plots had been in operation for 18 years, soil samples were taken from the limestone- and burned-lime-treated plots in 1899 by a student studying under Dr. William Frear of the Pennsylvania Experiment Station. Composite samples from the four tiers were analyzed by Hess, the student. He found a difference of only .2 percent organic carbon and .0169 percent soil nitrogen in favor of the limestone-treated soil. Dr. Cyril G. Hopkins of the Illinois Agricultural Experiment Station computed from these small differences in favor of limestone that for each ton of burned lime used there was destroyed 4½ tons of farm manure and more than $7.00 worth of nitrogen.*

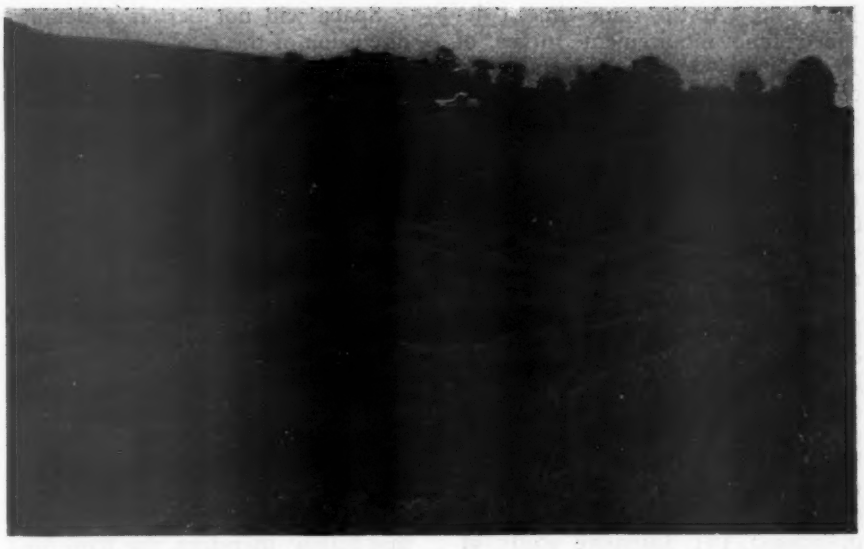
I was privileged in 1911 and '12 to be a student of Hopkins and I considered him the most impressive teacher I had ever known. So profound was his teaching that following his death it became a sacrilege

*Hopkins, C. G., *Soil Fertility and Permanent Agriculture*, pp. 106, 107.

at Illinois State University to question the truth of his teachings. As I sat one day and listened to his statements concerning burnt lime products I felt that he was wrong but had no proof at that time. Even if I had I would have been too scared to stick my neck out and question him. Upon my return to Penn State, however, I made a more thorough study of these same plots and found the source of the trouble. The increase in organic carbon and nitrogen was due to charcoal present on the limestone and not on the burned lime plots. This deposit of charcoal was derived from a residue left when timber was burned and prepared to supply charcoal for an old iron furnace one mile from the plots (1792-1848). The charcoal was present on only one of the four tiers of plots. Comparison of each of the other three plots showed no significant difference in nitrogen and organic matter content of the burned lime and limestone treated plot soils. (Soil Science, Vol. XVIII, No. 3, Sept., 1924). Data will be presented later to show you the results secured at the end of 50 years of continuous treatments. Judge for yourself if you think burned lime, even 25 tons, has had any effect upon the destruction of soil organic matter. The teaching of Hopkins had a profound influence, however, and caused unjustly the mid-western discrimination against its use, not so in the eastern states.

Pennsylvania Lime Experiments

As stated earlier, the unfortunate period of "Impropaganda" which led to confusion and distrust in the minds of the farmers was made possible by the lack of definite experimental evidence concerning the comparative values of different forms of lime and their relative effects upon the soil. In full realization of this unfortunate situation, the writer began in 1912 a series of experiments designed to make possible a detailed study touching on the many mooted questions pertaining to the agricultural value of lime. From 1912 to 1916 these experiments were in the nature of laboratory and greenhouse studies as a preliminary step toward permanent field plot experiments. In 1916 the first of a series of field plot experiments was begun on DeKalb soil followed in 1918 by similar field studies on Volusia and Westmore-



• A bumper crop of clover hay in southeastern Pennsylvania. Manure and burned lime products from the farm kiln have made possible a succession of crop yields unexcelled elsewhere.

• A wheat harvest in southeastern Pennsylvania, the bread basket of the state. Here the the farmer from the days of William Penn has known that poverty ends when liming begins.

A farm scene in the heart of Lancaster County, Pa., where for over two centuries burned lime products (from oyster shells, then limestone) have paved the way to a permanent agriculture with crop yields of over five times the state average.

land soils. At the same time a detailed lime requirement survey of Pennsylvania soils was begun and completed in 1920. The various lime experiments involved the following studies: (1) Relative value of limestone of different degrees of fineness (laboratory and field studies); (2) Comparative values of various forms of agricultural lime; (3) Different rates and frequency of application of liming materials; (4) Effect of lime on the microbiological activity of acid soils of different pH involving nitrification, nitrogen fixation, rate of organic matter decomposition, bacterial numbers and availability of soil nutrients; (5) the relative needs or response of different grain and forage crops to lime applications; (6) Intensive study of the results of the Jordan Soil Fertility Plot treatments from 1907 to 1947, and (7) Correlation of chemical and microbiological soil factors with crop yields.

Space will not permit a detailed discussion of the results secured from these experiments and only those facts which have a direct application to the more practical phases of liming will be presented.

Preliminary to the discussion of the practical applications it seems pertinent at this point to make the two following statements: (1) The results secured showed beyond doubt that the value of any form of basic lime used in soil treatments is dependent upon the calcium and magnesium oxide (CaO and MgO) content. If applied to the soil on the basis of equal lime oxides of similar fineness the various forms of basic lime compounds have the same crop producing value. In the discussions that follow, therefore, the term *lime* refers to lime oxides irrespective of their source. (2) The results of these experiments furnished your author with definite information which enabled him to stop the publication of lime pamphlets designed to confuse and mislead the farmer. Today I can truthfully state that the lime producers and the workers in our agricultural experiment stations are in accord and are cooperating one with the other, in an effort to guide the farmers, through the respective Agricultural Extension Representative, to a fuller understanding of the importance of lime in their scheme of soil treatments.

Pounds per Acre of Nitrogen and Organic Matter Found in the Soil at the End of 50 Years of Continuous Treatments

	Plot Soil Treatments 1881-1931				
	No Treatment	Limestone	Burned Lime	6 tons Manure	6 tons Manure Burned Lime
	lbs.	lbs.	lbs.	lbs.	lbs.
Nitrogen	2,444	2,452	2,474	3,388	3,652
Organic Matter	58,600	57,000	59,600	77,400	81,800

Lime and Soil Organic Matter

In 1931 at the end of 50 years of continuous treatments the plots of the Jordan series were sampled in detail. Included in the plot samples were those which have received limestone and burned lime each rotation since 1881. Total nitrogen and organic matter were determined on each plot soil. The following data are presented as a further answer to the claim of Hopkins concerning the destruction of organic matter by burned lime.

There are no significant differences between the nitrogen and organic matter content of the untreated soil, the limestone and the burned lime treatments. There is, however, a significant difference in favor of burned lime when used with manure. This is the final answer to this question and half a century ought to be long enough to prove the point, especially since a total of 25 tons per acre of burned lime and 50 tons of limestone have been used. (Four tons of limestone and two tons of burned lime per rotation.)

Nature of Acid Soils

The properties of acid soils have been the subject of careful study for many years. As the result of these studies many conflicting theories have been advanced due to the fact that this undesirable soil condition is a complex one involving many factors which tend to arrest the normal functions of the soil. The presence of toxic substances, both organic and inorganic, the absence of basic lime, decreased availability of essential plant food, and, most important, the great reduction in the

• Daisies do sometimes tell. The upper picture shows the daisies seeded by Nature to conserve and beautify acid land abandoned by man. The lower view is the same field two years later, after clover seeding and the application of lime and commercial fertilizers.

number and activity of the soil micro-organisms upon which a fertile soil is dependent, all play a major role in reducing crop yields.

Rejuvenating Acid Soils with Lime

It has been shown conclusively that when lime is applied in sufficient quantities to acid soils, these sterile or partially sterile soils are quickly restored to normal productivity if the lime application is followed by the use of commercial fertilizers or animal manure.

The following results serve to illustrate the relative effects of different applications of lime to a very acid soil. The rates of liming are indicated by the degree of acidity corrected expressed in terms of change in soil pH. Remember that pH 7.0 indicates a neutral soil reaction. Above pH 7.0 increase in alkalanity and below pH 7.0 relative degrees of soil acidity. Results are expressed on the basis of soil of pH 7.3 taken as 100.

	Soil pH				
	7.3	7.1	6.0	4.5	3.8
Number of soil micro-organisms	100	84	77	45	18
Rate of nitrification	100	81	72	31	10
Rate of manure decomposition	100	113	98	70	48
Rate of soil organic matter decomposition	100	80	78	57	31

The heaviest application of lime which produced a pH 7.3 gave the highest results in restoring the very acid soil to normal. Our long-time field plot experiments, however, have shown conclusively that with the one exception of alfalfa, the most economic returns from liming were secured when smaller applications of lime, 1,000 pounds of lime oxides per acre, are applied once each rotation depending in amount upon the initial soil reaction. We now know that it is not necessary to completely correct acidity to plow depth if the lime is harrowed or disked into the upper 3 to 4 inches of soil to the grain seed bed on which clover is to be seeded.

Lime and Phosphorus Availability

In acid soils the phosphorus is combined with iron and alumina to form a compound in which the phosphorus is unavailable to most farm crops such as barley, corn, wheat, and many of the forage crops. It is very important, therefore, that on acid soils lime should always be applied some time in advance of the application of superphosphate, in which case the phosphoric acid will combine with the lime oxides. As an example, the plot soil of the Jordan series which has received manure without lime was found to contain 44 pounds per acre of available phosphoric acid compared with 103 pounds present in the soil which received lime and manure. Also an untreated plot soil was found to contain 37 pounds of available phosphoric acid compared with 64 pounds per acre in the adjoining plot soil which receives lime alone.

Lime and Fertilizer Efficiency

During the first 40 years of the Jordan Soil Fertility Experiment no lime was applied except on three plots where lime was included in the scheme of treatments. Beginning in 1922 on tier 2 and in 1923 on tier 4, lime was applied in amounts sufficient to correct most of the acidity present. During the first 40 years where certain treatments, such as sulphate of ammonia, were used as the source of nitrogen, the acidity increased in amounts sufficient to greatly reduce the yields of the four crops of corn, oats, wheat and hay. The summary below shows the monetary returns received from the four crops based on the average of two rotations before and after liming.

The above lime data served to emphasize the importance of lime in the maintenance of soil fertility. Although our farmers are becoming more lime conscious each year, millions of dollars are even now wasted annually in labor and through the use of commercial fertilizer and manure on unlimed land or where it is used too sparingly. Our carefully-conducted field experiments have pointed out this fact. It behooves all of us, therefore, to double our efforts to bring home to all farmers the fact that lime paves the way toward a permanent agriculture and makes it possible through its use to realize maximum profits from investments in more expensive plant food materials.

In looking back through the years of my efforts in behalf of the farmer, during which time lime has been a major theme, I realize more and more that my compensation is found in the truth of the statement by Lincoln, "No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought as agriculture. I know nothing so pleasant to the mind as the discovery of anything that is at once new and valuable—nothing that so lightens and sweetens toil as the hopeful pursuit of such discovery; and how vast and how varied a field is agriculture for such discovery."

Value* of the Four Crops Produced on Unlimed and Limed Land (4 acres)

Soil Treatment	Unlimed	Limed
Untreated soil	$ 56.10	$ 78 62
PK	117.62	145.08
PKN (N from Nitrate of Soda)	134.43	156.87
PKN (N from dried blood)	114.29	156.77
PKN (N from sulphate of ammonia)	34.78	156.79
8 tons of manure	124.33	154.76
Average	$ 96.93	$141.48

*Crop values are based on the averages of farm crops prices between 1926 and 1930.

Vast Fuel Savings Possible Through Use of Insulation

Nearly a billion dollars and vast quantities of fuel could be saved each year by applying known heat-conservation measures to existing dwellings in the United States, Dr. R. R. Sayers, Director of the U. S. Bureau of Mines, made known in releasing a report describing the use of mineral products in home insulation.

Although weatherstripping and storm windows have long been recognized as effective ways to conserve heat, the more recent practice of insulating walls, floors, ceilings, and roofs has proven the most effective heat-savng method yet employed. In winter insulation reduces the escape of heat, and in summer it curtails the penetration of the sun's rays. The result is an increase in human comfort and health.

Tests have shown a 30-to-45 percent conservation in heat through insulation, with an enormous potential savings in fuel and dollars, the report states. In a peak war year, 1944, consumers paid approxmately $2,175,000,000 for fuel, exclusive of gas. If heat-loss had been reduced only 30 percent by insulation, consumers would have saved $653,500,000, together with considerable reserves of irreplaceable national fuel resources.

Mining operations have begun at Cody, Wyo., at the Gypsum Products Company's plant. Lloyd Taggart is president and general manager. The plant, formerly owned by the Wyoming-Midland Gypsum Company, has been remodeled, and will be in full production this spring.

Limestone—The Foremost Of Natural Fertilizers

By WM. A. ALBRECHT

Department of Soils, College of Agriculture
University of Missouri

another P&Q first exclusive

LIMING the soil has long been an agricultural art. It has now become a modern scientific agricultural practice. Putting ground limestone on the soil may well be viewed as a case of an old practice that has now come to a newer scientific understanding. It is only recently that scientific facts have given us comprehension of the soil and plant relationships that underlie the services which the limestone renders for the crop.

Limestone has always been associated with the production of leguminous plants. They in turn have always been considered good feed for young and growing livestock. We are just coming around to realize that the calcium supplied by limestone is a fertilizer, as the ancients probably also considered it. Calcium is, in fact, the foremost one of all the nutrient elements for animals and man that can be put into the soil to help it grow bigger crops, giving us better nutrition through them.

We use limestone to supply calcium, rather than to remove soil acidity. Acid, or sour soils, have long been known to be low in productivity. Seemingly like spoiled food about which we say, "It is poor food because it has soured," so we have come to consider "soured" soils as poor soils. This reasoning has appeared sound because we found that limestone, which reduces the soil acidity, also makes better crops. As a consequence of the observation of these two simultaneous results, namely, reduced soil acidity and better crops, from applying limestone, our soils have been widely tested for their degree of acidity in the belief that the acidity was the cause of the soil's low productivity. Limestone has been the ammunition in the war on acid soils.

During our belligerency toward soil acidity, a very important fact escaped us. It was the recently recognized one, namely, that while the carbonate part of the limestone is removing the acidity, the calcium going with the carbonate is serving to nourish the crops. Delicate electrical instruments and refined chemical tests helped us to detect and measure the acidity, or the activity of the hydrogen ions that is the cause of it. Since hydrogen is the most active of all elements, and since there are more hydrogen than any other ions in the universe, we might well expect this to be the first one of which the activity would come under such accurate measurement. This attention which was focused so sharply on soil acidity resulted in disregard of the declining and deficient soil fertility.

Unfortunately, neither calcium nor any other plant nutrients have as yet submitted themselves to any such minute evaluations. As a result of these facts, the hydrogen ion or soil acidity has held prominence. This prominence resulted because hydrogen could be easily detected and conveniently measured, and not

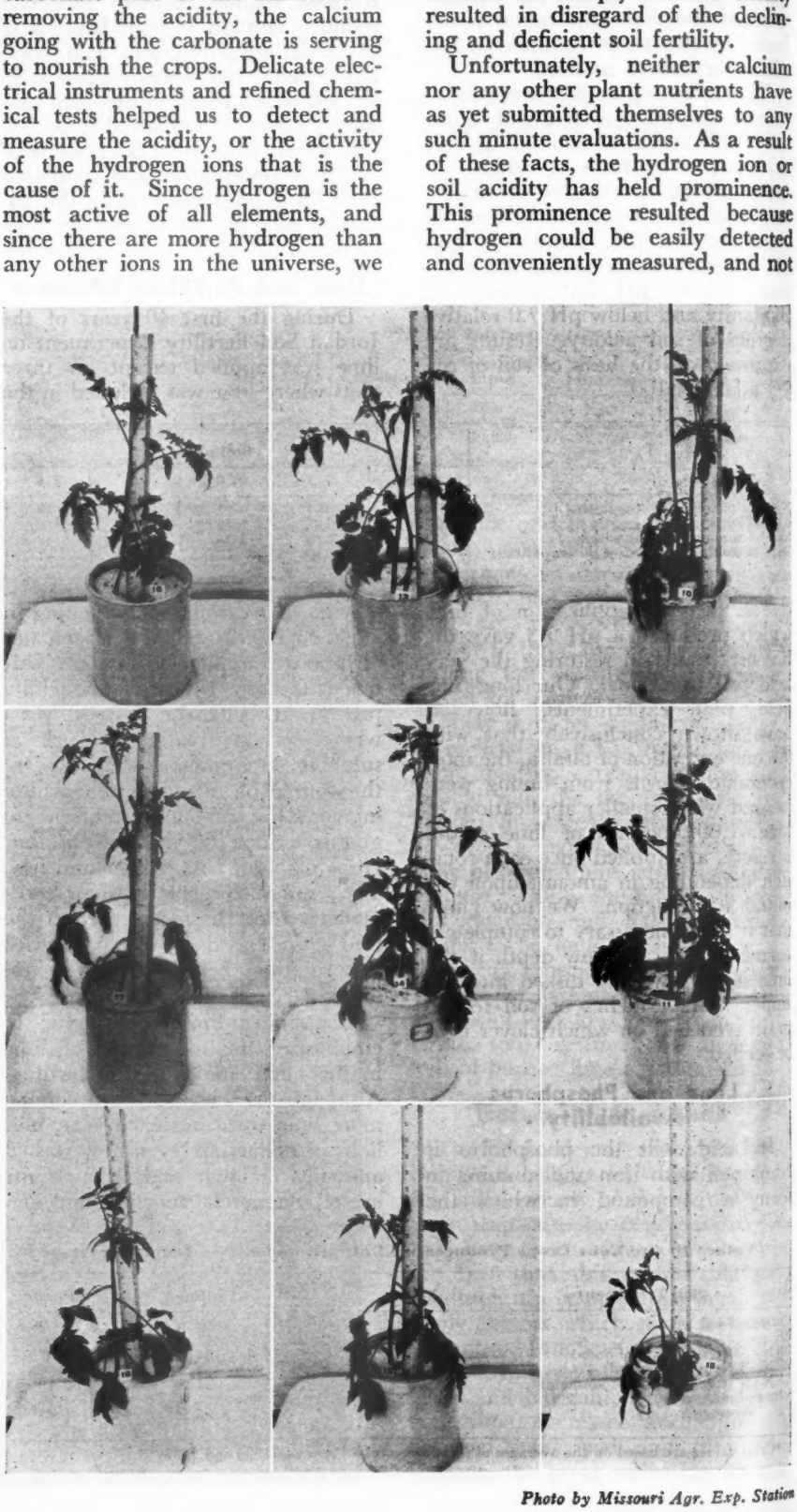


Photo by Missouri Agr. Exp. Station

• Calcium goes with other fertilizers. Increasing the amount of calcium applied for these three series of tomato plants (left to right) suggests trouble from extra lime when only little phosphate was used (lower row) but no injury and increasing benefit as more (middle row) and still more phosphate (upper row) accompanied the calcium.

because of knowledge of its activities in the soils or in the plants. Its presence in the soil did not call attention to the absence there of the calcium, the magnesium, the potassium, and the other plant nutrients, all of which are more deficient as hydrogen is more abundantly present.

It was necessary, therefore, to use the physiology of the legume plants and to study their growth and chemical composition when they were produced on soils of which the acidity was nearly neutralized by limestone, or calcium carbonate, in contrast to these properties of those grown on soils likewise given the plant assay method that revealed the forms of calcium sulphate and calcium chloride, neither of which reduces the soil acidity. It was this plant assay method that revealed the fact that soil acidity is in reality a deficiency in soil fertility. It is a soil situation wherein the hydrogen of no nutrient service to the plants has come into combination with the clay to take the place of several nutrients that are there in productive soils. This method demonstrated also that legumes will grow on a soil that is acid provided it supplies amply the fertility or stock of plant nutrients needed.

Unwittingly we have carried calcium as a fertilizer along when we were applying its carbonate as the remedy for soil acidity. The same has also happened for our unrecognized benefits in "correcting the acidity of commercial fertilizers." More fortunately, however, the dolomitic, rather than the pure calcium limestone, has been the "neutralizer for fertilizer acidity." Consequently, both calcium and magnesium have been coming along with the nitrogen, phosphorus and potassium (N, P, K) in fertilizers, though probably more because dolomite has higher "neutralizing value" than because of the planned desire to add these two extra nutrients for which no additional fertilizer charges are made. This is a case where calcium has been going ahead of—while going along with—the other fertilizers, even though it was not regarded as such in the designing of commercial fertilizers.

The fact that calcium has been the major component of a fertilizer, like superphosphate for example, has reacted to the pronounced benefit of lateritic or red soils, so common in the South. These soils have little absorbing or exchanging capacity. Consequently they do not absorb or retain much hydrogen or acidity. There has been no "war on soil acidity" in the South. There is, however, a serious need for calcium as a fertilizing help in better animal and human nutrition coming from the soils and as a help for those plants which synthesize the proteins and other chemical complexes of higher food values. While tropical soils do not invite the use of limestone in a war on their acidity, they do demand limestone to supply calcium as a fertilizer in its own right.

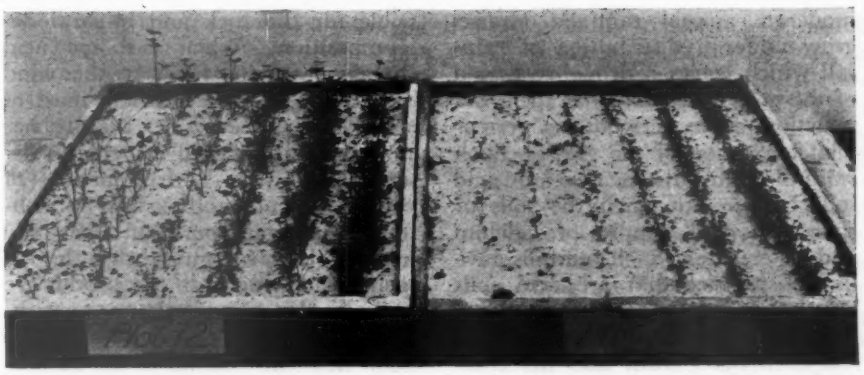


Photo by Missouri Agr. Exp. Station

• Calcium plays an important role in the early life of alfalfa when its percentage emergence and early growth are improved on the soil (Plot 12) that was given limestone some years ago.

Ash analyses of plants leave confusion about the services of calcium. Unfortunately for the services which mineral nutrients coming from the soil render in the plants, the chemical analyses ignite them to destroy their organic combinations. Such procedures measure mainly the percentage of the ash constituents in the dry plant tissue. This gives no concept of the many organic compounds of plant construction into which the calcium, for example, may have been combined, or in the syntheses of which this nutrient plays an important part. It leaves mainly the idea that the plant hauls either a large or a small load of calcium and other minerals from the soil.

Ash analysis is no measure of the functions performed by the chemical elements. It fails to point out in what period of plant growth the calcium and other minerals are taken from the soil in major or minor amounts. It has not given calcium its decided importance in the very early life of many plants. It has not emphasized the help of calcium in moving other nutrients into the root of the plants, which Professor A. C. True of the University of Pennsylvania has called a "synergistic effect." It has given undue importance to potassium, for example, as a fertilizer for potatoes because of emphasis mainly on the potato tubers. It has left unemphasized the facts, (a) that the tops of the potato plants carry more calcium than does a legume crop like red clover, and (b) that lime may be necessary as a fertilizer for potatoes more often than commonly surmised. It is such incomplete chemical analyses, with their attention to the ash constituents only rather than to the more complete organic compounds, that have given the confusion about potato scab in relation to soil acidity, instead of its connection with deficient nutrients, even with respect to calcium.

Ash analyses may measure the mineral elements of soil origin, but such measurements fail to mean much when the more efficient function by the plant in synthesizing important compounds is not necessarily dependent on a larger amount of one single plant nutrient taken from the soil. Unfortunately, such chemical measures do not inform us as to what constitutes the properly-balanced supply of all nutrients at any time, nor how that balance must be modified for highest plant efficiencies in different periods of growth. It is such ash analyses that have failed to classify calcium as a fertilizer of even greater deficiency on many soils than are phosphorus and potassium. Yet both of these latter two are so common in and emphasized by the mixed goods of commercial soil treatments, the calcium contents of which get no mention on the label or in the sale.

Soil acidity must be removed by fertilizing with calcium, plus other nutrient elements. That soil acidity should have come under condemnation by the recent scientific attacks on it seems strange, now that we look at the pattern of life on the globe and find it most concentrated, not on the neutral and alkaline soils, but rather on the acid soils bordering those that are calcareous. Agriculture has reached its high food output by the help of grazing animals. Grasses as feed for grazing animals are most common and most nutritious on soil developed under

moderate annual rainfalls. Grasses grow under a distribution of rainfall which leaves a droughty period of the growing season that spells destruction of the trees but not permanent extinction of the grasses. Such rainfall distributions develop acid soils but do not leach the soils of their adsorbed supply of calcium and other bases. Such rainfalls gave us the prairies that are acid soils but that are also stocked with plenty of calcium, as was the virgin soil of the corn belt. Man and his companion animals for his support have multiplied most rapidly and concentrated themselves most highly, not on soils that are neutral, but rather on those that are acid in their reaction. Yet we have recently gone forward under the belief that soil acidity is highly detrimental and should be completely neutralized. Scarcely have we cherished the thought that soil acidity might even be beneficial, as the locations of higher concentrations of populations and their better agricultural support suggest.

When soils are a temporary rest stop of rocks and minerals on their way to the sea and to solution under increasing rainfalls encouraging their faster travel in that direction, we must credit carbonic acid as the natural agency that is mainly responsible for the rock and mineral decomposition. When carbonic acid breaks down the rock, another kind of acid, namely, a soil acid must of necessity be the result. Nature has long been using acid reagents to decompose rocks and minerals of which the end products are nourishment for vegetation. But it has only recently been recognized that the soil acids or clay acids in our productive soils are the agencies that are weathering rocks and minerals to release their nutrient contents to the adsorbing clay and thereby for exchange to the growing crops. Soil acidity is an integral part of the chemical mechanisms within the soil by which the mineral reserves are broken down to fertilize the crops.

Surely, then, we must recognize in these facts the need for the soil to be acid. At the same time we must recognize the necessity for that soil to contain mineral reserves, among which limestone is the foremost. This must be there to provide calcium for plant nourishment while this stone is being decomposed on contact with the soil acid. In such a concept of the function of soil acidity, its partial removal is a means of fertilizing the soil and crop with available calcium through the service of this acidity in breaking it out of the limestone rock. Viewed in this light, the application of limestone to the soil is a case of applying calcium as a mineral fertilizer for its mobilization from inert rock form to active form on the clay by means of the acidity of the soil. Surely, then, we would not remove from the soil this mobilizing agent and thereby lose its valuable services.

Can we use too much limestone on the soil? Now that the soil acidity is considered a means of decomposing the soil minerals to make their fertilizing contents available to plants, it is evident that a productive soil is one which contains not only hydrogen or acidity, but one which is also supplied with the elements that are nutrients or fertility. Just as our application of limestone is a means of letting the soil acidity mobilize the stone's contents of calcium, so many other minerals with fertility contents may be applied to the soil and made available by the soil acidity. Rock phosphate is an example. Other minerals may come into use later as fertilizers under this same category. It was from a mixture of such rocks and minerals that soils were originally developed to form the clay residues and to load these with the many nutrients that give our productive soils.

When the plant roots are exchanging their hydrogen or acidity to the clay of the soil for its fertility contents, we may well visualize the fact that they might remove these so completely that the soil becomes infertile and highly acid. Then if we should put limestone on such an acid soil until all of its acidity is removed, would this make it a highly productive soil because it was now neutral, and because that neutrality was obtained by loading it with nothing but calcium, of which the associated carbonate in the limestone had neutralized the acid after the calcium had displaced it from the clay? If a soil is neutral but completely saturated with only one element—even if it be a plant nutrient ever so extensively taken by plants and animals as food—is that soil going to be any more productive than when completely saturated with the non-nutrient hydrogen that makes it very acid? Alkaline soils are not necessarily productive merely because they are not acid. They are often deficient in some elements of fertility, just as acid soils are deficient in some. Thus a very acid soil made completely neutral by liming as the

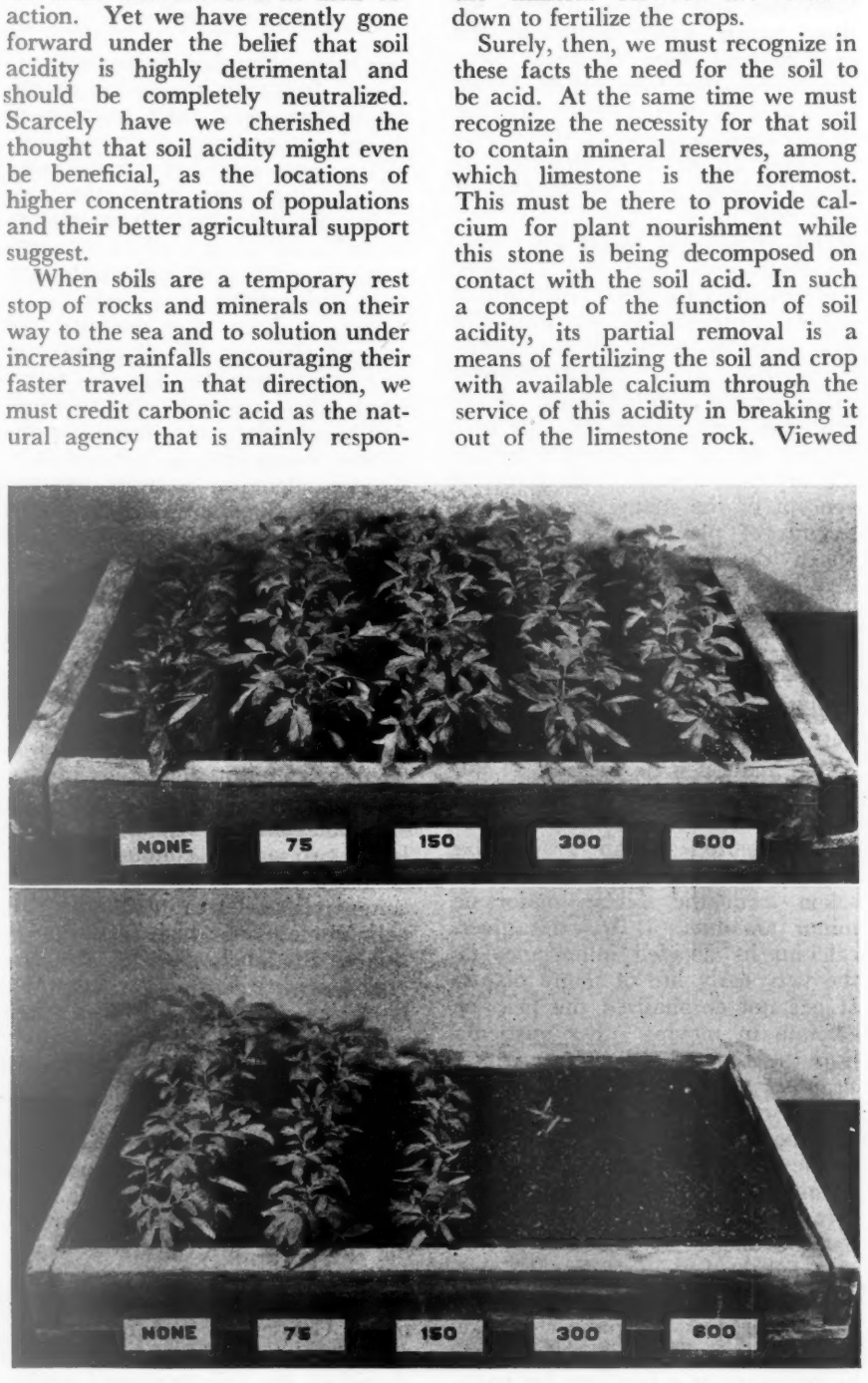


Photo by J. Bushnell, Ohio Agr. Exp. Station

• Fertilizers carrying considerable calcium, like superphosphate (above), do not injure the young plants even at high rates of application. But fertilizers without calcium, like ammonium sulphate (below) and others, are injurious at lower rates.

only treatment becomes a hazardous condition in that the acidity, or hydrogen, on coming originally into the soil, displaced too completely many other nutrient elements as well as the calcium. Very acid soils, then, need other fertilizers besides the calcium we provide by applying the limestone.

Calcium has been the foremost deficiency in fertility on extensive soil areas. That limestone has been the most effective fertilizer is indicated by its use to the total amounts of more than ten million tons in the State of Missouri, for example, in less than ten years. The amounts of all other fertilizers used has not been one-fifth that of the limestone during their maximum use. But now that the calcium shortage in the soil has been remedied to strengthen that one weak line, the next item representing the next weakness will need to be strengthened.

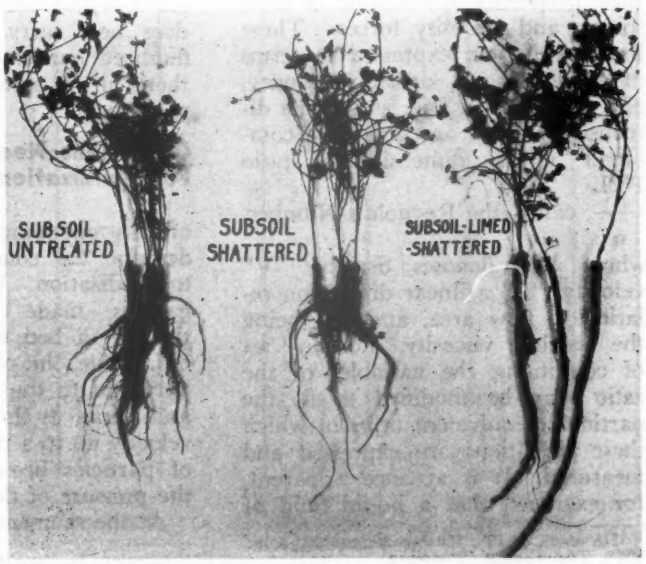
On soils limed now for some years, the potassium deficiencies are being indicated more commonly by crop symptoms. Corn stalks are not so strong and may break over. The ears of the corn are less solid or more chaffy where heavy liming is used to grow legumes that are turned under as green manure. Heavy liming and consequent reduction in the degree of soil acidity are bringing on deficiencies of manganese. This deficiency in the crop may possibly reach greater importance as liming is more generously used, and when we recall that perosis of chicks is caused by deficiencies of manganese in their ration. Manganese, commonly considered among the minor nutrients, takes on major importance if its deficiency in the soil can reflect troubles in the animals by way of the crops they consume.

Boron and iron, too, are demobilized when the acidity of the soil is much reduced. Alfalfa, root crops, some vegetables and other crops require more boron than may be found available in a soil that has been given heavy dosages of limestone. Whether the excessive carbonate or the excessive calcium is responsible for the trouble has not yet been learned in all these cases. Nevertheless, the trouble is prevented by caution against believing that if a little limestone is good, much more of it will be better. Calcium used alone is not able to offset the shortage of other nutrient elements. Plant nutrition demands calcium in generous amounts for its direct services, and also for many benefits it exercises in mobilizing other nutrients. Nevertheless, soil acidity is also required. It, too, has much mobilizing power for nutrients toward which excessive calcium and neutrality of the soil exercise quite the opposite or a demobilizing effect.

Calcium must lead the parade for other fertilizers. Calcium plays a prominent role in—and is always associated with—protein production by plants. Amino acids, the building blocks of proteins, are not synthesized by animals and humans. They are the synthetic product of plants and micro-organisms but most commonly by those kinds of these producers for which liberal supplies of lime are requisite. Animals and man are always in the struggle for proteins. On the contrary they obtain carbohydrates more easily. On the calcareous soils of the prairies, rather than on the lime-deficient soils cleared of their forests, do we find production of animals less difficult. Animals are grown on the former and fattened on the crops from the latter. By the same token do we have poor reproduction and growth of animals on soils that, through crop removal and neglect, have been depleted of their calcium and the other fertility elements that are associated with it in fertile soils. Lime is first on the list of needs for soils that are to be kept high in animal production.

It was on those soils containing acid properties in the surface horizon, but calcium in their deeper layers, that the bison originally supported himself. It is on these same soils that production of beef and mutton rose to the magnitudes of which we boast. It is on the soils of greater deficiencies in calcium and other fertility constituents where the hog of mainly fat output is the king. Humans, too, may be fitted into the soil picture with more tooth troubles on calcium-deficient soils, as the draftees for the Navy demonstrated. Calcium, which constitutes forty percent of limestone, makes this rock an important fertilizer for the soil in service to man as well as to plants and animals.

Limestone is no longer merely a soil conditioner in terms of the control of the degree of soil acidity. It is the provider of the foremost element for fertilizing effects. It is the mobilizer of other nutrients. It is the catalyzer in the process of synthesizing proteins. It has been delivering these services ever since it was a part of the art of agriculture, dating back some 40 centuries. But, unfortunately, only recently have we realized that calcium is only one of the essential nutrients needed by plants and that many others must come along with it for most efficient crop production. Nevertheless, when animal and human nutrition are taken as the goals of crop production, calcium heads the list of the nutrient elements and stands out as the one demanded in largest amounts from the soil. In terms of human foods for their quality dependent on the soil, limestone is the contributor of calcium and is the synergistic agent for other nutrients; which services make it the foremost of the fertilizers.



• Limestone plowed under helps build up the soil by building down. Limestone put down deeper into the shattered clay subsoil encouraged sweet clover roots to go down into the moist subsoil rather than spread themselves through the shallow, too often dry, surface soil.

A fire originating from grass fires recently caused damage amounting to between $30,000 and $35,000 at the Lenawee Sand & Gravel Company's plant near Tecumseh, Mich. Flames destroyed the power house, in which were housed two diesel engines, a large generator and other equipment. More than 7,000 gallons of fuel oil also was lost.

In Humboldt County, Ia., Don M. Pierson, Harry Zigrang and W. B. Williams are operating a new gravel washing plant known as the Iowa Sand and Gravel Company. Operations are in progress east of St. Joe.

Fluidization—Its Implications for The Lime and Nonmetallic Industries

PART I—INTRODUCTION TO FUNDAMENTAL CONCEPTS

By WOLF G. BAUER
Consulting Engineer

MUCH of the material appearing in this introductory paper was written over two years ago, but it has been deemed necessary to withhold publication until now for reasons due to incomplete experimental data to link available research results to practical applications. It has only been during the past year that initial pilot plant work has indicated more and more clearly that this new process technique would seem to be destined to play a major role in many chemical or heat-reaction processes between solids and gases. Furthermore, only three or four articles on fluidization have, so far, appeared in the literature, and these have been of a rather general nature.

Before applications of this new processing technique to the several phases of lime manufacture may be discussed, a subject as new as this one will have to be developed carefully and systematically so that the reader will not only grasp the basic controlling factors, but be prevented from drawing unsound conclusions by too much generalization. Hence, this initial discussion will center around facts and figures primarily of interest to engineers and chemists. Later installments, however, will deal more specifically with operating techniques and economic considerations as far as they have been obtained. Also, a final word of caution,—experimentation in this new field has been secretive for patent reasons and limited because of the small number of investigators; and for that reason this discussion necessarily covers only facts gathered in the writer's own work, which at this time is still very much restricted in scope and in publishable detail.

The fluid gas-solid state or phenomenon has been put, so far, to only very limited use in the fluid catalytic cracking process of the petroleum industry, and also for mineral separation purposes on the sink-float principle. It is destined to fill the chemical engineer's needs for a tool and technique with which to improve many present gas-solid reaction and heat exchange problems. But before we go further into its possibilities in industry, both general and specific, let us examine this phenomenon in the dim light of our present limited knowledge.

The subject is a broad one, as it involves aerodynamics as well as hydraulics in modified form, and leads us into many, as yet, undetermined, variables when the application involves the laws of thermodynamics. However, in attempting some explanations of the various observed phenomena, we shall gain at least a better grasp of some of the implications and the order of values that might apply.

THE FLUIDIZATION PHENOMENON

The fluid gas-solid state exhibits certain similarities with the liquid-solid state, at least in its en-masse behavior. The condition of "teeter" is a familiar one in the field of ore dressing and probably most closely approaches that of the gas-fluidized solid state under discussion. Some of the laws applying to solid particles in teeter condition in true liquids also hold for particles whose agitation is caused by gas flow.[1] However, the variations of fluid flow with temperature, particle size, shape, and specific gravity are much greater and change much faster with gas than with a liquid as the motivating fluid.

In comparing such systems, it would probably be best to compare their properties as functions of their inertia and viscosity forces. These forces are often expressed in terms of fluid velocity, density, viscosity, and passage flow area as a single dimension. They are generally combined in a dimensionless ratio $\frac{PVL}{u}$, called the Reynold's Number, where "P" denotes density, "V" velocity, "L" a linear dimension relating to flow area, and "u" being the absolute viscosity. For any set of conditions, the variables of the ratio may be modified to fit the particular equivalent units in which these conditions are expressed and measured. It is at once apparent, for example, that a liquid fluid of comparatively high viscosity must flow at lower velocities in order to exhibit flow characteristics similar to a gaseous fluid of relatively low viscosity. R. C. Binder[2] states that "if viscous and inertia forces determine the flow for a prototype, then mechanical similarity between model and prototype is realized when the dimensionless Reynold's number for the model equals the Reynold's number for the prototype." This would also hold true for comparing the teeter condition of solids in different gases and liquids, provided we do not deal with such high fluidized beds and pressures that we must consider the gas a compressible fluid, and allow for additional viscosity and density in the lower regions of a fluidized column.

The term fluidization is of rather recent origin, at least when applied to the state or phenomenon here described. It designates the state of equilibrium in which a suitable mass of solid particles is held in partial suspension and extreme agitation by a suitable stream of gas flowing through it. Since the physical properties of this gas-agitated mass approach closely that of a fluid, the term fluidization aptly describes the condition of such a system.

Now it should be understood at the outset that fluidization does not mean an entrainment of small particles in a flowing stream of gas, such as may be carried in grinding mills or dust-collection systems by fans. In fluidization systems the escaping gas may not necessarily, and usually does not, carry away any of the fluidized particles, but merely holds them in a state of agitated suspension.

Conditions Needed For Fluidization In order to attempt an explanation of this phenomenon, let us briefly describe the conditions which lead to fluidization. When a current of gas is made to flow upward through a bed of materials resting on a grate, the pressure drop is proportional to the height of the bed, and varies as the square of the gas velocity up to a point where the bed of particles begins to be lifted by the pressure of the current.

At the moment when the velocity

[1]Hancock, R. T., *Mining Magazine*, Aug., 1936, *The Teeter Condition.*

[2]Binder, R. C., *Fluid Dynamics.*

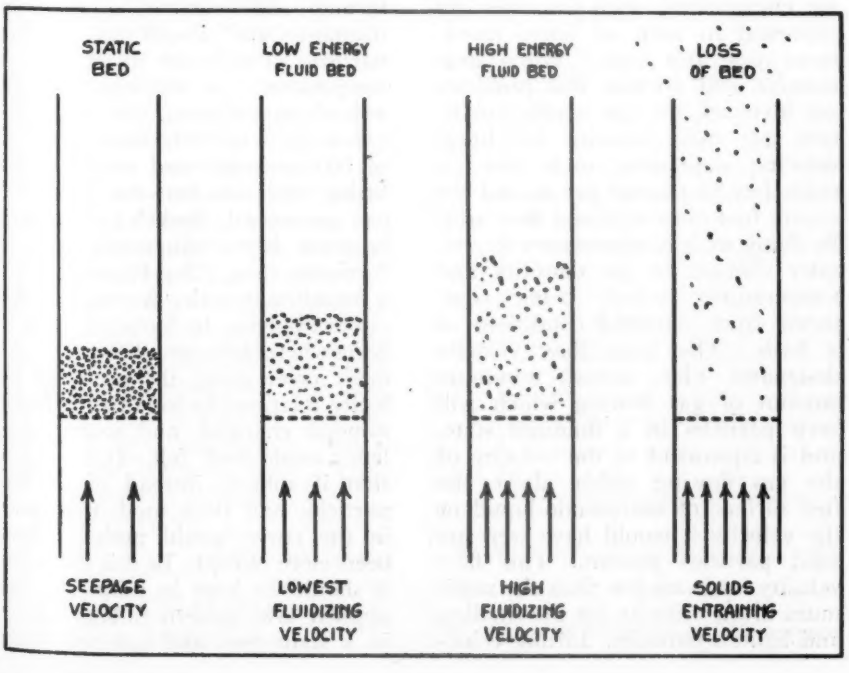
has reached the point where lifting begins, the bed resistance changes unequally in different areas of the bed. These areas themselves also shift continuously. As the velocity increases in the bed of solids at rest, the pressure increases up to a point where it is slightly more than the weight of material, after which it starts lifting and expanding the space between particles, and the pressure drops due to lowered resistance.

Now if we fluidize a bed of solids such as sand in a container or column, the walls of which are parallel and vertical, we might wonder why, if the velocity is apparently high enough to lift the largest particles, the gas stream does not carry these and even smaller ones out of the container. In other words, why should there be a distinct top-surface to this pseudo-liquid?

To answer these questions, let us again describe conditions leading to fluidization, but let us start this time with a few particles only, instead of a bed of materials, and note the effect of concentration of solids under constant gas flow and changing pressure.

For the purpose of illustration we shall pass gas at a constant rate of flow up a tube or column of uniform diameter, and controlled to remain constant with any required change in pressure. If we drop suitable small particles into the top of this tube, they will slowly sink through the ascending gas current if they are of the right size and density. They will eventually reach a bottom grid placed across the tube through which the gas is passing upward, and remain lying fairly quietly thereon. However, as we continue to drop more particles, and allow an increasingly greater amount of them to accumulate on the grid, the gas passage through them becomes more and more restricted, thereby increasing the velocity at the level of the particles to the point where it reaches lifting velocity, despite the fact that total mass velocity or gas flow remains constant. Now at this point we have low-energy fluidization. In other words, we constrict a gas passage with enough suitable particles to a point where the increased velocity due to constriction *momentarily* lifts the particles. This lifting effect can, of course, only take place where there is constriction, namely in the immediate spaces between particles. (See VL in Figure 4). In the vicinity of these particles the steady gas stream coming up through the grid is broken up into many small and irregular streams because of the obstructing particles, and these streams may be visualized as small jets of gas which widen out as soon as they leave two or more particles, but may be split and compressed again while passing through the next group of solids. At the last constriction they recombine into the original ascending steady stream with a velocity below that necessary for lifting. (See Figure 1.)

Fig. 1. Gas velocity stages through bed of closely-sized solids.



From this picture it can readily be seen why we have a very definite and pronounced "surface" of the fluidized solid material. The height of this surface depends on the original height of bed of solids, and the fluidizing velocity or energy of the system (Figure 1a), however, we find that the fluidizing velocity is independent of the height of the bed. From a velocity which just keeps

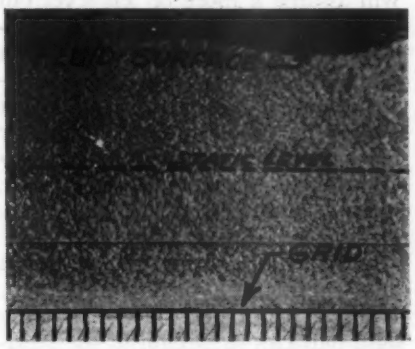


Fig. 1a. Photograph of fluidized limestone bed.

the particles in agitation, to a higher velocity which lengthens the trajectory path and increases the kinetic energy of the solids but is just below the actual carrying flow,—the height of the fluidized bed increases, the surface is raised and becomes less pronounced and more irregular, and the density of the pseudo-liquid decreases. Beyond this velocity, the smallest or lightest particles begin to be carried upward and out of the "liquid". It is quite apparent from this that there must be a limiting size and specific gravity range of solids for practical fluidization for any given gas velocity.

Fluid-Bed Flow Continued fluidization or gas agitation of solids can only be maintained within a container which restricts the lateral movement of the particles past the fluidizing current. If no such confinement exists, the area over the gas stream will slowly become empty of suspended particles.

Now if we fluidize material in a lateral confinement such that in one direction only no confinement exists, the particles will eventually move toward this unlimiting direction for the simple reason that once a particle is thrown in that direction and out of contact with other particles which might strike and deflect it, it will not bounce from a confining wall, therefore leaving the mass. The whole might be likened to our conception of gas molecules confined under pressure in a vessel. If this vessel is a pipe, flow is in one direction both by pressure and by diffusion. Here our analogy ends, however, and we must make further comparisons with the liquid state, as we have gravity factors to contend with in our fluidizing phenomenon.

Since the particles are all held in each other's proximity by the force of gravity, and are returned

to the pseudo-liquid by the same force whenever they are projected above it, the "liquid" surface itself will assume a more or less level but irregular plane when no lateral displacement of the mass itself takes place. It will remain level or realign itself to a level plane whenever disturbed. Since there is no surface tension phenomenon here, the pseudo-liquid does not exhibit the quiet, smooth, and distinct surface lines of liquids. An analogy with true liquids, on the other hand, would hold in most physical comparisons. It might well be considered that the solid particles in motion in the fluidized mass exert a pressure on the confining walls, but due to the unidirectional fluidizing current, this pressure is not equal in all directions. This pressure would be some fraction of the kinetic energy imparted to the particles by the gas, and represents that part transmitted by the number of impacts per unit time. This, of course, is only a fraction of the pressure exerted by the fluidizing gas against the walls.

The kinetic energy of the fluidizing gas may be likened to heat energy imparted to liquids whose molecules increase in agitation with increase in heat energy. Just as with heating of liquids, higher fluidizing velocities or gas energies will decrease the liquid density and reach a point where particles begin to leave the liquid surface, a state analogous to boiling. And so, because of these characteristics, this gas-agitated solid suspension behaves as a liquid in its flow characteristics, flowing when there exists a differential in height of surface at any two points, or difference in specific gravity of contacting fluid masses.

Fluidization Systems At this point we probably should make a differentiation of several fluidization systems relative to their en-masse movement or flow. Such classification would clear up any comparison misunderstandings in various applications. It would further contribute to clearness if we hereafter speak of the solid particles in the fluidized system as the "solid phase", compared to the "gas-phase", and a possible third "liquid (droplet) phase" which might appear from condensed vapors, or be actually added in certain scrubbing or wetting processes.

In practically any foreseeable fluidization process, there would probably take place some movement or translations of the fluid mass from an inlet to an outlet within the apparatus or system. Depending on whether the solid phase moves vertically up, down, or laterally in a more or less closed circuit completely filling the passage, or whether it moves vertically down, or laterally with a distinct free surface, or even remains fixed; — such fluidization technique may be classified according to how the solid phase is allowed to move in the processing zone. We may speak then of confined up-flow and confined down-flow as employed in catalytic cracking processes at present; confined lateral and other directional flow as in the Kinyon conveying systems; free surface down-flow and fixed bed fluidization and free surface lateral or open channel flow fluidization as worked out by the writer.

Very little need be explained at this point other than to mention that all of the characteristics of a dry fluid state are maintained in each one, except for the relative translation of the mass from one point to another by increasing or decreasing the gas mass flow velocity above or below normal fluidizing values. So before we go into more detail of differentiating between the above arbitrary classifications, let's examine some of the governing factors that hold in any of these systems.

THE VARIABLES OF PARTICLE SIZE, GAS VELOCITIES, AND PRESSURES

Most relationships between solid and gas phase of fluidization systems may be expressed in terms of particle size, shape and density, and the pressure, velocity, density, and viscosity of the fluidizing gas.

In this paper, the terms "flow" and "lifting" velocities are employed. Except in cases where temperature and gas density variations are encountered, such velocities are expressed in units of lineal movement per unit time. When heat transfer and friction loss problems are involved, we can readily substitute gas mass velocity for lineal velocity, expressing such flow as cubic feet or pounds per second per square foot cross sectional flow area. By doing so, it is unnecessary to consider changes in gas densities and temperatures, values being computed from standard conditions as a basis. The term flow velocity designates the actual minimum amount of gas flowing which will keep particles in a fluidized state, and is equivalent to the velocity of the gas flowing either above the free surface of the pseudo-liquid or the velocity it would have were no solid particles present. This flow velocity is always less than the minimum lifting velocity for the smallest and lightest particles. Lifting velocity is the minimum carrying or entraining velocity of the particular solids in case.

The velocity of the gas as it enters the solid phase in fluid condition increases to slightly more than the minimum lifting velocity of the largest particles. One probably should not speak of a single velocity of gas in the fluidized mass, as there are numerous gas streams all at different velocities, arising from the ever-changing constrictions between the agitated particles. This is readily observed behind glass walls by watching the relative speed and motions of the solids, and the surging channeling of gas streams.

The lifting velocity is a function of the particle size, shape, and density, and also of the density and viscosity of the particular gas. The relationship between gas velocity and particle diameter is not constant with any particular solid and gas, but follows certain laws, depending on the amount of disturbance created in the gas by the motion of the solid.

Laminar Flow Relations When particles are very small and gas velocities are low, Stoke's law holds generally. This law simply states that the resistance of a particle acted upon by a fluid stream is directly proportional to the relative velocity between solid and fluid, and that this velocity is proportional to the square of the particle radius or diameter. That is to say $V\text{-}KD^2$. Actual velocity, of course, is also a function of the density and viscosity of the fluid, and density of the solid. This law applies in the field of streamlined or laminar flow, where no disturbing eddy currents increase the resistance and absorb energy. For particles of dolomite in air at room temperature, as employed in the writer's experiments, this ranges between 325- to 150- mesh sizes (45 to 100 microns) and corresponding lifting velocities between ½ to 1½ feet per second. Stoke's Law applies, however, below this range down to 3 micron sizes. (See Figure 2.) On a logarithmic scale, the slope of this curve applying to Stoke's Law is 2. Somewhere between 200- and 100-mesh screen sizing, the gas lifting velocity relationship for this particular mineral changed, and some turbulency made itself felt. It is possible that if spheres instead of crushed particles had been used, this break in the curve would probably have been more abrupt. In this discussion it should be kept in mind that the applied laws govern falling spheres in a static gas, and not necessarily

suspension of an oscillating solid particle in a moving stream of gas. However, for our purpose of analysing a range of conditions, these given laws apply fully enough, and we may substitute lifting velocity for terminal velocity of falling solids in a still fluid. We may also discount the buoyancy effect when the fluid is a gas, since the correction would be considerably less than the accuracy of testing. Stokes Law would therefore become $V = \frac{gD^2Ps}{18u}$, where in C.G.S. units, V = particle or fluid (relative) velocity, g = gravity acceleration (981 cm./sec.^{2}), D = diameter of particle (cm), Ps = density (true) of a solid phase, P = density of gas (0.00123 for air), M = fluid viscosity (poises, 0.00018 for air).

Although the size range with which we are concerned generally does not reach below 3 microns, it might be of interest to mention that below this size velocity changes as to a modified Stokes Law, which takes into consideration a cumulative rate increase in velocity with decrease in size, so that the curve bends toward an infinitesimal size and velocity ratio. Below this range, or .1 microns, Brownian Movement Laws hold.

Intermediate Gas Flow Relations As we increase particle size and velocity above the values to which Stokes Law applies, we enter a field where some disturbance in the gas flow is created, and resistance now varies as the velocity raised to the ⅔ power. In this range relative solid-gas velocity is almost directly proportional to the particle-size reduced by some constant, or V = D — K. For the particular solid upon which tests were made, this range is somewhere between 100- and 10- mesh (130—1600 microns) at velocities between 1.3 to 30 feet per second. The average interpolated curve has a slope of approximately 0.9. This is the field in which sand sizes are fluidized to create a dry pseudo-liquid for mineral separation processes. The law which applies in this range is an intermediate law, sometimes designated as the Allen formula. This may be written as follows: $V = \frac{0.15g^{2/3}DPs^{2/3}}{P^{1/3}u^{2/5}}$ where the units are given in C.G.S. system as explained under Stokes Law.

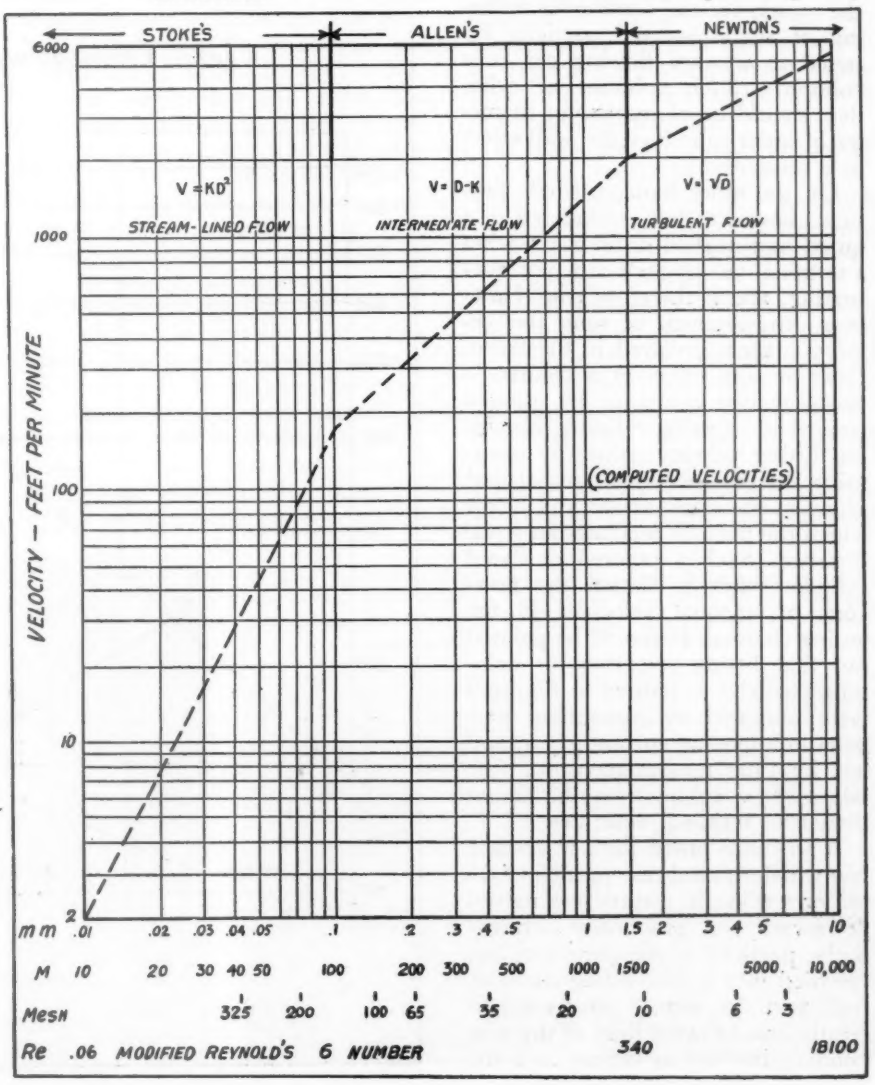
High Turbulent Flow Relation The plotted curve, representing the formulae in each of these ranges, shows another break commencing at about 10- mesh (1600 micron) size. From this point on the average slope of the curve is approximately ½, showing that the applied formula is of the order $V = K\sqrt{D}$. This is called the Law of Newton and applies to strongly turbulent flow. $V = 1.74\sqrt{\frac{gDPs}{P}}$ where units are in the C.G.S. system as explained under Stokes Law.

From these formulae, it can readily be seen how the effects of fluid viscosity diminish, and those of kinetic forces increase with higher velocities and greater turbulency. Since the Reynolds number expresses this relationship of forces, it forms a valuable criterion for comparing and evaluating conditions existing at different velocities and for fluids and solids of various densities. A modified Reynolds number for the various particle sizes is therefore shown also in Figure 2, and is computed for dolomite in order to fit the experimental data plotted.

As pointed out before the formulae represent values for terminal velocities of falling bodies in a quiet gas. It would seem that the reversed process, namely that of holding a particle in suspension, or at a constant level in a column by passing gas up against it, would show similar values. This was investigated in detail by workers for the French Bureau of Mines in tests with fine coke particles, who found lifting gas velocities in a cylinder to be greater than falling velocities of similar solid particles.

Particle Force Components A particle in free suspension in a current of upward flowing gas is acted upon by three forces,—that due to gravitational pull, which acts downwardly; that due to the sum of the frictional forces acting on its surface (shearing and impact) which act upwardly; and the buoyant force, which is due to the difference in specific gravity

Fig. 2. Graph showing the application of Stoke's Allen's and Newton's laws to different micron sizes.


STOKE'S
ALLEN'S
NEWTON'S
V = KD²
V = D-K
V = √D
STREAM-LINED FLOW
INTERMEDIATE FLOW
TURBULENT FLOW
(COMPUTED VELOCITIES)
VELOCITY - FEET PER MINUTE
6000
1000
100
10
2
mm .01 .02 .03 .04 .05 .1 .2 .3 .4 .5 1 1.5 2 3 4 5 10
M 10 20 30 40 50 100 200 300 500 1000 1500 5000 10,000
Mesh 325 200 100 65 35 20 10 6 3
Re .06 MODIFIED REYNOLD'S NUMBER 6 340 18100

of the solid and the fluid, and which also acts upwardly. If the particle moves vertically in relation to the confining walls of the gas stream, these forces are unbalanced, and cause translation of the particle up or down. When the frictional and buoyant forces pushing upwardly on the particle become greater than the force of gravity, the particle moves in an upward direction at an increasing speed until the forces are again in equilibrium, at which time a constant upward velocity is maintained. Aside from violent agitation and oscillations due to the disturbing influence of adjacent particles, up-flow and down-flow fluidization is governed by this relation of the acting forces on the solid phase, the resultant velocities and pressures due to friction being average effects of the disturbing fluctuations.

It is quite apparent that in dealing with particles in the sand size range, a size which can be studied under the influence of gas flow with the naked eye, the necessary gas velocities needed to hold such particles in suspension are such that the flow is difficult to steady, and that this is the reason for the continuous teetering of single isolated particles exposed to upward flowing gas in a column. (Such columns as cylinders should be of maximum diameter in order to reduce the wall effect to a minimum.)

On the other hand, a single particle allowed to fall unhindered in a quiet, undisturbed static gas reaches a terminal velocity which is not fluctuating, and is therefore true. However, measurement of time and velocity is more involved in the latter. Drag or wall effect in a column is probably best overcome by using a conical or tapering cylinder, obtaining lifting velocity values by measuring the cross-sectional area of that plane in the cone, above and below which the particle oscillates an equal distance. Such a tapered or flared cylinder tends to flatten the flow-cone of unequal velocities in the testing channel. It should be pointed out that lifting velocities for dolomite particles as plotted in Figure 3 were obtained by suspending particles in a moving current of air, and not by time measurements of free fall, so these volumes may be higher than true terminal velocities.

It was also noted that, whereas a few widely spaced fine particles falling or settling in a static gas moved downward in practically straight paths, particles of the same size, but crowded into a descending cloud of such particles, moved downward in erratic and agitated lines of descent, similar, but not as violent as a true fluidized bed. This must be charged to the eddying and wave disturbances set up by adjacent particles. Such action may best be studied with a more viscous fluid such as water.

Size Range Of Fluid Bed In studying the curves plotted in Figure 3, we note that the fluidizing or flow velocity follows more nearly the Newtonian Law, whereas the velocity for lifting currents runs close to the intermediate turbulent flow law, for the same particle size range. This might be expected, as considerable more turbulency is encountered under the conditions at which flow or fluidizing velocity is expressed. The diverging curves show the increasing effect of particle interference and the increasing ratio in sizes of particles between lifting and entrainment velocities.

If we select a point on the lower fluidizing velocity curve representing one particle size, then this point would represent the lowest flow velocity of the system and the maximum size particle fluidized in that system. By following horizontally across to the lifting or entraining velocity curve, we establish a second point, which would represent the smallest size particle that may just be lifted by this gas velocity. This allows the establishment of an approximate range of sizes for a fluid system of any gas velocity level. It can be seen that, in the range of sizes within which these curves were determined, the ratio changes approximately with the velocity. For any particle size, a velocity above the lifting velocity curve would result in entrainment, while any velocity below the fluidizing velocity curve would cause static bed conditions. (See Figure 4.)

These two curves then may be used to show the range of fluid energy level. The flow curve would represent "low-energy" fluidization, whereas the lifting velocity curve would be "high-energy" fluidization for any one particular size particles. This may be stated still differently. With a maximum range of sizes, as

(*Continued on page* 104)

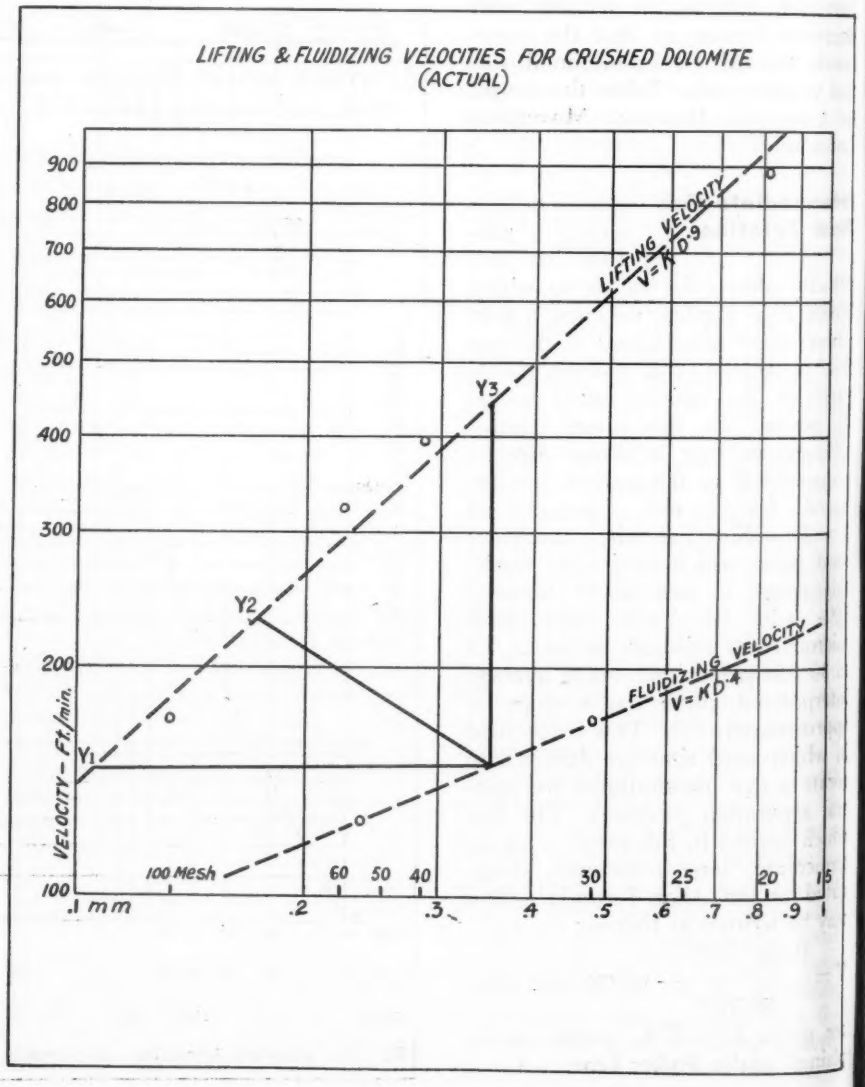


Fig. 3. Graph showing the lifting and fluidizing velocities for crushed stone.

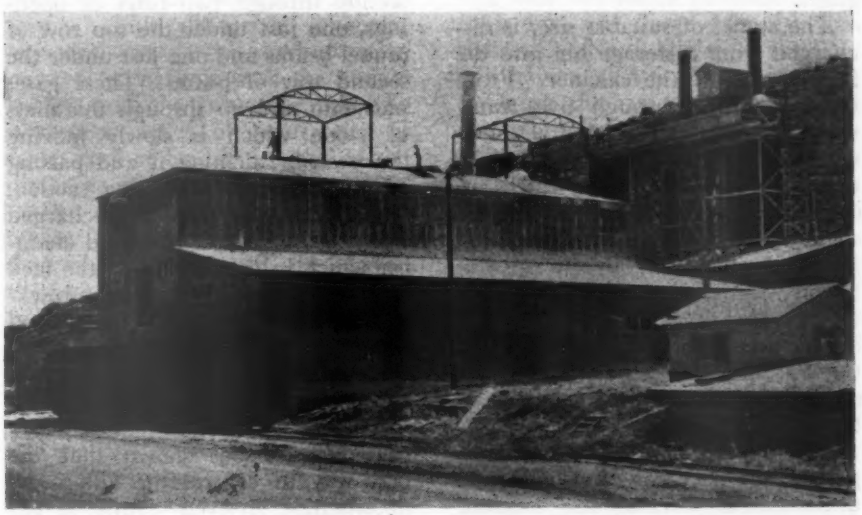
Calciners at Utah Lime & Stone Co. Set Operating Records

By WALTER E. TRAUFFER

another ON THE SPOT report

IN the May 1942 issue of PIT AND QUARRY an article was published describing the Ellernan Calciner, an entirely new type of kiln designed specifically to burn small-sized limestone. In this article, T. R. Ellerbeck, vice president and general manager of the Utah Lime & Stone Company, Salt Lake City, Utah, and inventor of this calciner, described it in detail and gave some of the results obtained in the short period the first two units of the company's plant had operated up to that time. World War II interfered with Mr. Ellerbeck's plans to make many other installations of this kiln. However, two of the kilns were sold and installed late in 1944, under government priority, for special low-temperature calcination of dolomite for production of magnesia. It also did not prevent him from installing a third and larger unit in his own plant in 1944. Now that the war is over, a fourth unit is soon to be installed in this plant and other installations are under way or planned in various sections of this country, Europe and Asia Minor.

The purpose of this article is primarily to give the latest operating data on the calciners installed in the Utah plant where the oldest unit is now in its seventh year of nearly constant operation. First, however, a little background on the development of this machine is necessary as well as a brief description of its design which is basically unchanged from the time of the other article.



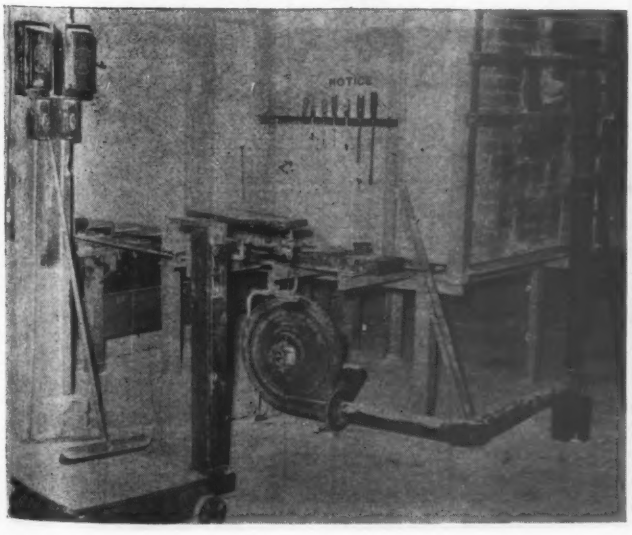
• A general view of the Utah Lime & Stone Company's plant at Dolomite, Utah, showing old vertical kilns (right). The roof, damaged by a storm, is being replaced.

The Utah Lime Plant at Dolomite, Utah, about 40 miles west of Salt Lake City, Utah, was an ordinary shaft-kiln plant with four Keystone-type kilns when the first No. 1 Ellernan Calciner was installed late in 1940. In 1941 a No. 1E unit was added and a No. 2E unit was installed in 1944. These units are known respectively as Kilns No. 5, 6 and 7. Their installation interfered in no way with the operation of the four shaft kilns, No. 1, 2, 3 and 4, but the use of the latter was gradually discontinued as the calciners were installed and proved their ability to carry the production load. The new No. 2E calciner (Kiln No. 8) to be installed soon, however, will be in the location of the No. 2 shaft kiln which is being dismantled. Later two more calciners will replace the other shaft kilns.

The Ellernan Calciner is a vertical direct-heat-transfer unit which combines in compact form a preheater, calciner and cooler. Its design can most readily be understood by referring to the accompanying drawings (Fig. 1). The design includes the following features:

1. Continuous feed, discharge and operation.
2. Tempering of the calcining gases to any desired temperature before they enter the calcining chamber.
3. Multi-variable discharge control to balance flow of material through all sections against calcining conditions in each section.
4. Separate positively controlled cooling air circuit.

Each calciner is completely instrumented with a fuel meter, an oven



• Left: The blower and burner on the oven (tempering chamber) side of one 5-ton calciner. Below: Left to right: J. F. Ellerbeck, general superintendent; T. R. Ellerbeck, vice-president and general manager; W. E. Trauffer, PIT AND QUARRY.

temperature recorder, an exhaust gas temperature recorder, and two draft indicators. The instrument board for the newest kiln (No. 7) has Bristol and Tagliabue recorders and Trimount and Meriam draft gages.

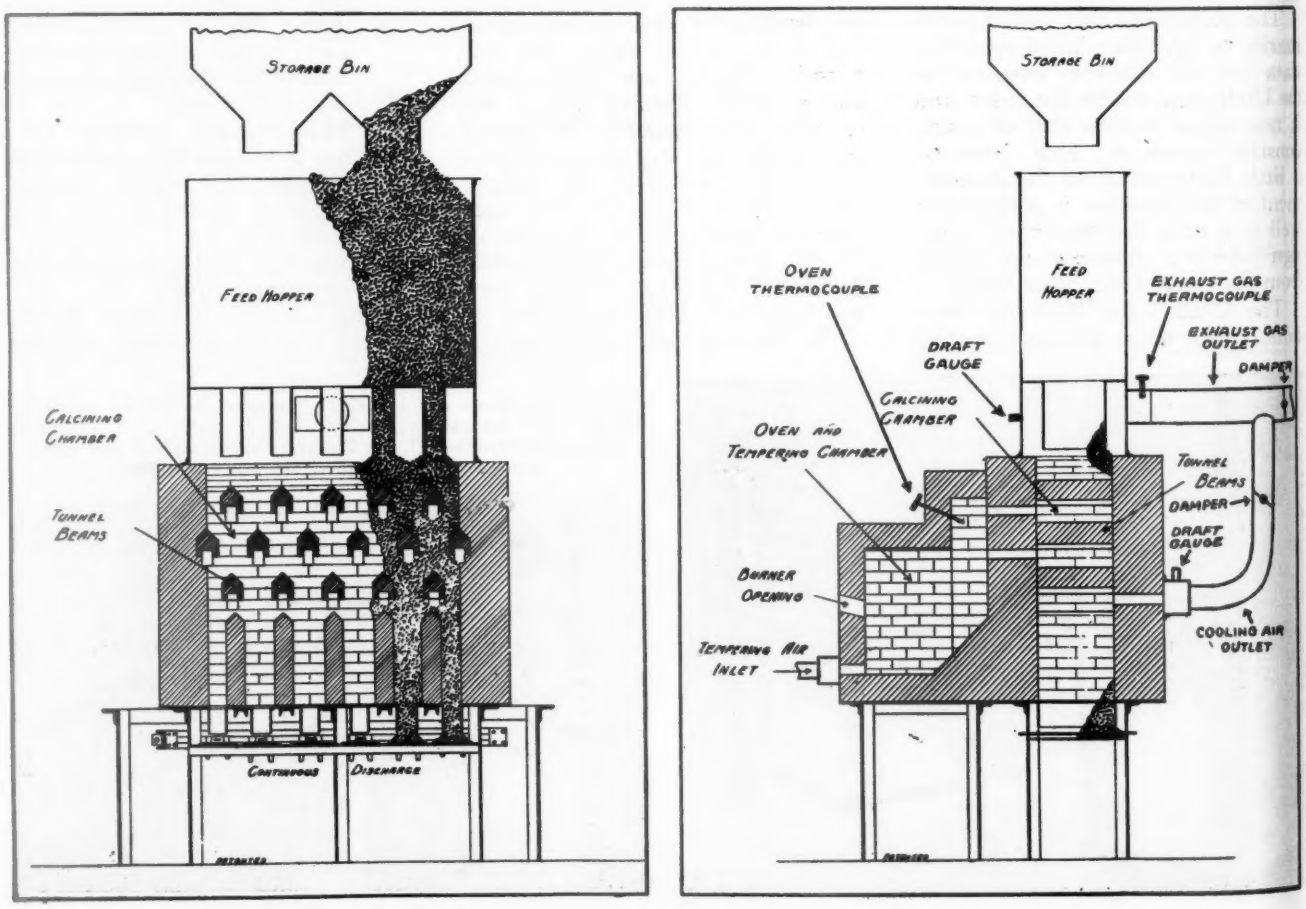
The stone, of suitable size, is discharged from a storage bin into the feed hopper of the calciner. From there it drops through five transverse openings in the hood chamber which serve as the preheaters, into the calcining chamber in which are three staggered rows of tunnel beams spanning it transversely. Under the last row of beams five transverse beams resting on the bottom of the calciner break the cooling section into six separate compartments over the discharge mechanism. The material moves through the calciner entirely by gravity.

The oven or combustion and tempering chamber, as shown in the drawings, is outside the calciner proper and is fired with one oil burner. This tips downward into the oven in order to project the short flame toward the stream of secondary or tempering air entering from atmosphere through an inlet at the bottom of the oven. The temperature of the calcining gases varies depending upon the characteristics of the stone being calcined. For the stone being used at the Utah plant a temperature of 2440 deg. F. is maintained in the oven which means that the actual calcining temperature in the kiln is about 2200 deg. F. The tempered hot gases enter the mass of stone in the calcining section through two rows of openings, one just under the top row of tunnel beams and one just under the second row of beams. These gases pass into and up through this mass of stone which is slowly moving downward, calcining it and passing on up into the preheating section. The gases are finally discharged from the stone into the hood chamber which is located around the feed spouts between the top of the brickwork and the bottom of the feed hopper. The gases are drawn from a central point in this chamber through a pipe by means of an exhaust fan.

Experience has shown that the best way to control the kiln is by maintaining an even volume of gas entering the calcining chamber. This makes operation of the calciner practically automatic except for minor adjustments at infrequent intervals once the proper balance is attained. There are no major variables in its operation. The main flow of gas out of the kiln controls the temperature. If this gas flow changes the primary air and the leakage remain constant and only the amount of tempering air entering the oven is changed. A change in the amount of tempering air would cause a change in the oven temperature. The draft fan has a damper in the discharge pipe which is remotely controlled from a point near the instrument panel. This damper is adjusted from time to time in order to maintain a constant volume of gas flow out of the kiln and consequently an even temperature in the oven. Slight changes in the draft required are caused by changes in resistance through the mass of stone and atmospheric temperature changes.

The open gravity discharge from the bin into the feed hopper maintains a constant level of material and consequently a fairly uniform leakage of air through the stone. This forms about one-third of the total exhaust air.

The material air seal above the calcining chamber is adequate by itself but the one below through the cooling section is not, as it lacks height. Rather than increase the height of the kiln by extending the cooling section a cooling air outlet is installed at the top of the section



• Fig. 1. Vertical sections of a calcining unit, showing the general design and flow of material and gases.

just below the bottom row of tunnel beams to maintain the proper balance. There is also a draft gauge on the cooling air header, and a damper in the pipe controls the percentage of this air which goes up through the material and the amount diverted through the header into the exhaust gas line. Once the damper is properly adjusted so that only as much cooling air enters as can be adequately preheated above the calcining temperature of the stone before it passes the middle row of beams it need not be changed as the exhaust and cooling air withdrawn then remain in proportion regardless of any adjustments made to the main damper in the exhaust gas line. These two additions to the exhaust gases ahead of the fan bring the exhaust gas temperature down from about 525 deg. F. leaving the stone, to about 300 deg. in the hood chamber and at the fan. The lime discharged from the cooling section is at almost atmospheric temperature. This system of draft control increases the fan load considerably but this is unimportant compared to the economy of cooler air at the fan and a cool discharged lime.

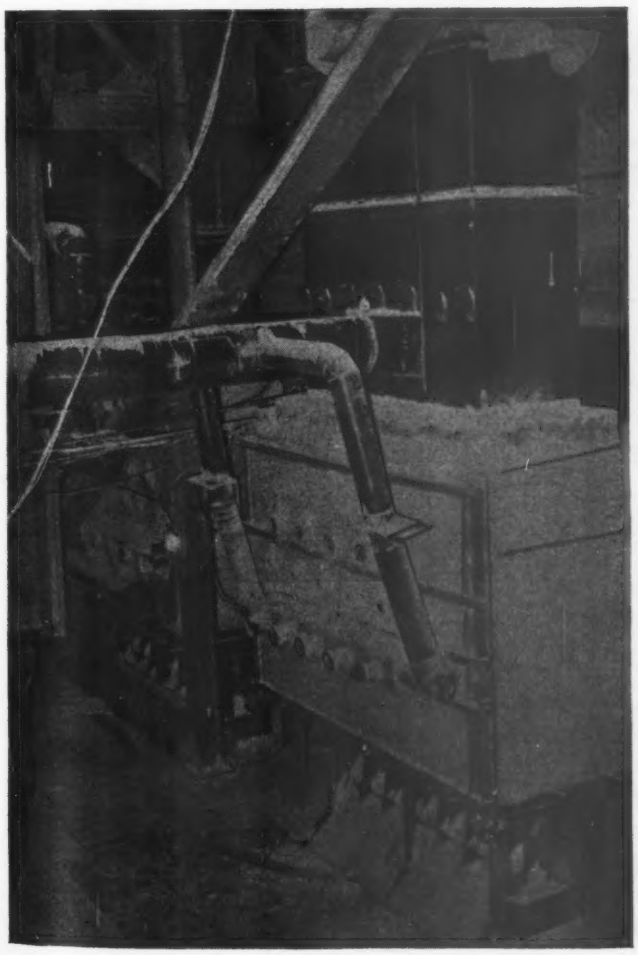
The flow of stone down through the calciner is controlled by the multi-variable discharge mechanism at the bottom of the cooling section. As the stone moves down through the calcining section, that portion of it which is closest to the source of heat inevitably gets a little more heat than that farthest from the source. This difference is slight, however, due to the stirring action created in passing over the tunnel beams, and the firing through two horizontal series of ports, and is taken care of by adjustments of the discharge mechanism.

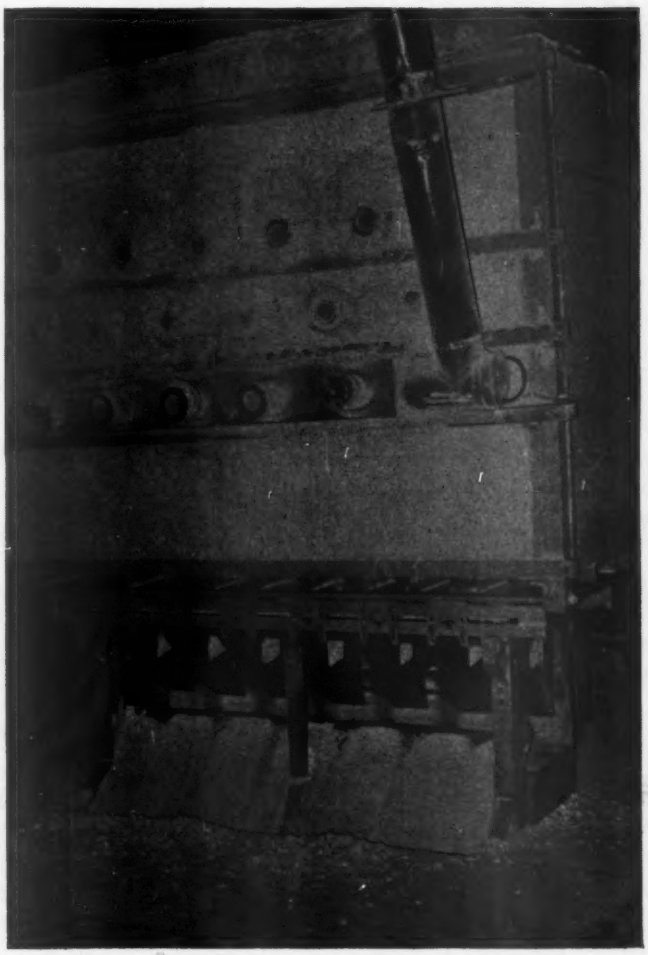
The discharge mechanism or feeder is set to discharge at a predetermined rate and is driven through a J. F. S. variable-speed transmission. Only at rare intervals when some wear factor makes it necessary by changing the output rate is the feeder speed adjusted. This occurs about every 10 days or two weeks. In this feeder provision is made so that the rate of flow through each of the six sections of the chamber may be varied independently of any other section. This makes it possible to balance the flow of material from each point in the kiln against the heat available at that point so that all the lime produced is calcined equally. The two small kilns originally designed for 4½ tons are set to produce 5 tons each and the large kiln 10 tons daily. The No. 8 kiln to be installed will have a 12-ton daily capacity.

Under the conditions existing at this plant it has been found advisable to set the burners of all the kilns to use 40 gallons of the No. 1 burner oil per ton of lime produced.

• Right: Draft and temperature gages for the 10-ton calciner.

• Below, left: Exhaust side view of the two 5-ton calciners, with cooling air and exhaust gas outlets. Right: One of the 5-ton calciners with discharge chutes tipped to discharge lime into a sample box on the floor.





This is a 137,600 B.t.u. oil of 34 gravity and this rate equals 5,504,000 B.t.u. per ton of lime. The fuel rate is only changed when there is a sharp change in the rock characteristics and sometimes months go by before an adjustment is necessary. A Denver Fire Clay burner with a 16-ounce pressure blower is used. The oil is automatically shut off in case of power failure to prevent damage to the kiln.

A heavier oil could be used more economically and this will be done as soon as the oil storage tank is moved closer to the plant and provision is made for heating it in cold weather. This change will be an operating economy as fuel consumption will be lowered somewhat and the heavier oil is much cheaper than that now being used.

It can be seen from the above description that, once the necessary adjustments are made, the operation of the calciner becomes nearly automatic. The operator watches the oven temperature gauge most carefully and adjusts the main damper only when there is a serious variation in temperature. Usually a slight adjustment is necessary every 2 or 3 hours and this could be done automatically. Normal draft is 0.75 in. in the exhaust hood and 0.5 in. in the cooling air header and this ratio is automatically maintained. In several days' run the exhaust-head draft may range from 0.72 to 0.76 in. and this is usually due to a change in resistance through the rock or changes in the atmospheric temperature.

Every 4 hours the operator checks the tonnage of lime produced and the fuel consumption. The oil reading is obtained by means of a counter and a stop watch and any variation over 1 percent from the set amount is adjusted through a needle valve at the burner. A 20-minute sample of lime is taken by flipping a gate to divert the material into a pan and its volume is measured in order to check the tonnage rate. As the weight of the lime per cubic foot is known this method is the most accurate. Any variation over 2 percent from the set amount requires adjustment of the rate of withdrawal. This is usually necessary every 10 days or 2 weeks and is done with a stop watch also but it has been found unnecessary to make these checks so often and an 8-hour schedule is being adopted.

Kiln No. 6 is adjusted to produce 5 tons of lime daily with a fuel consumption of 40 gallons per ton and a temperature of 2440 deg. F. at the oven thermocouple. The burner has a chart which shows that the desired rate is 8.33 gals. per hour and 2¾ cu. ft. of discharge for 20-min. sample. On a firing sheet, Fig. 2, he records the hourly oil meter and hood and header draft readings, the volume sample and oil rate checks made every four hours, and the weight per cu. ft. of the sample. Fig. 3 is a typical 24-hour chart from the recorder connected to the oven thermocouple showing how uniform the temperature is and how close it stays to the set 2440 deg. Fig. 4 is a typical 24-hour chart from the recorder connected to the exhaust gas thermocouple.

These calciners require very little attention or maintenance. They are shut down every 12 to 14 months for a periodic check or cleanout. Very little hard cake is found in them and only a little dirt on the top row of tunnel beams. Usually no patching is necessary but sometimes as many as 4 or 5 of the tunnel beams need to be replaced. This is not difficult as these beams are separate from the main brickwork. It takes four days to cool off the calciner, replace the beams, and get it back in full operation. If some of the lining needs to be replaced another day is required. The No. 6 kiln has just been partly relined for the first time since it was built in 1941. The upper two-thirds of the 4½-in. lining in the calcining section was replaced, requiring about 250 high-alumina brick. In the light of present knowledge a 10-year lining life is now expected.

Fig. 2. Firing sheet for the 10-ton calciner on March 16, 1947. On this sheet are recorded periodic checks made on the operation.

FIRING SHEET _____ KILN NO. 6 DATE 3/16/47 FIREMAN 1 2 3

SHIFT NO.	20 MINUTE VOLUME SAMPLES: SAMPLE TIME	VOLUME: CU. FT.	VOLUME: PLUS INCHES	RATE TONS PER DAY	SAMPLE WEIGHT PER CU.FT.	OIL RATE: TIME PER GAL.	OIL RATE: GAL. PER HOUR	TIME	DRAFT	OIL METER READING	LIME DISPOSAL		HEADER DRAFT
						CHECK 7:13	142	1 AM.	.72	77284	PULVERIZED		.52
				D.C →				2 "	.68	77292	HYDRATE		.49
						RESET		3 "	.68	77301	SK'D. 90# NEW		.48
1	12:15	2	9½"	5.0	51¼#	7:13	8.33	4 "	.70	77309	" " OLD		.50
								5 "	.70	77317	CARS		.50
	4:15	2	9¾"	5.0	51½#	RESET 9:13	8.33	6 "	.70	77326	STORAGE		.51
								7 "	.70	77334	WASTE		
								8 "	.70	77342			.50
						CHECK 7:10		9 AM.	.70	77351	PULVERIZED		.50
								10 "	.76	77359	HYDRATE		.53
2	8:15	2	9½"	5.0	51#	RESET 7:10	8.33	11 "	.76	77367	SK'D. 90# NEW		.53
		BELT	TIGHTENED	D.C. CHANGED TO →		7:03 →	142.50	12 NOON	.80	77376	" " OLD		.57
						RESET		1 PM.	.80	77384	CARS		.57
	12:15	2	9¾	5.0	49½#	7:11	8.33	2 "	.70	77393	STORAGE		.50
								3 "	.76	77401	WASTE		.53
								4 "	.76	77410			.53
						CHECK 7.15	8.33	5 PM.	.76	77418	PULVERIZED		.55
								6 "	.78	77426	HYDRATE		.55
						RESET		7 "	.76	77434	SK'D. 90# NEW		.55
3	4:15	2	9	5.0	51½	7.15	8.33	8 "	.78	77443	" " OLD		.55
								9 "	.78	77452	CARS		.52
	8:15	2	9½	5.0	51¼	RESET 7.11	8.33	10 "	.78	77460	STORAGE		.54
								11 "	.78	77469	WASTE		.56
								12 "	.78	77477			.57

Calciner No.	No. 1	No. 2
Capacity—tons/24 hr. burned lime	6	12
Stone size	¼"—¾"	½"—1½"
Width overall	10'0"	14'0"
Length overall	10'10"	14'1"
Height (floor to top of feed hopper)	15'10½"	27'6"
Height of brickwork	6'½"	11'0"
Height of feed hopper	6'0"	10'0"
Usual oven temperature	2350°F	2300°F
Exhaust gas temperature (average)	350°F	350°F
Discharged lime temperature	100°F	100°F

The standard construction and specifications of these calciners is shown in the accompanying chart.

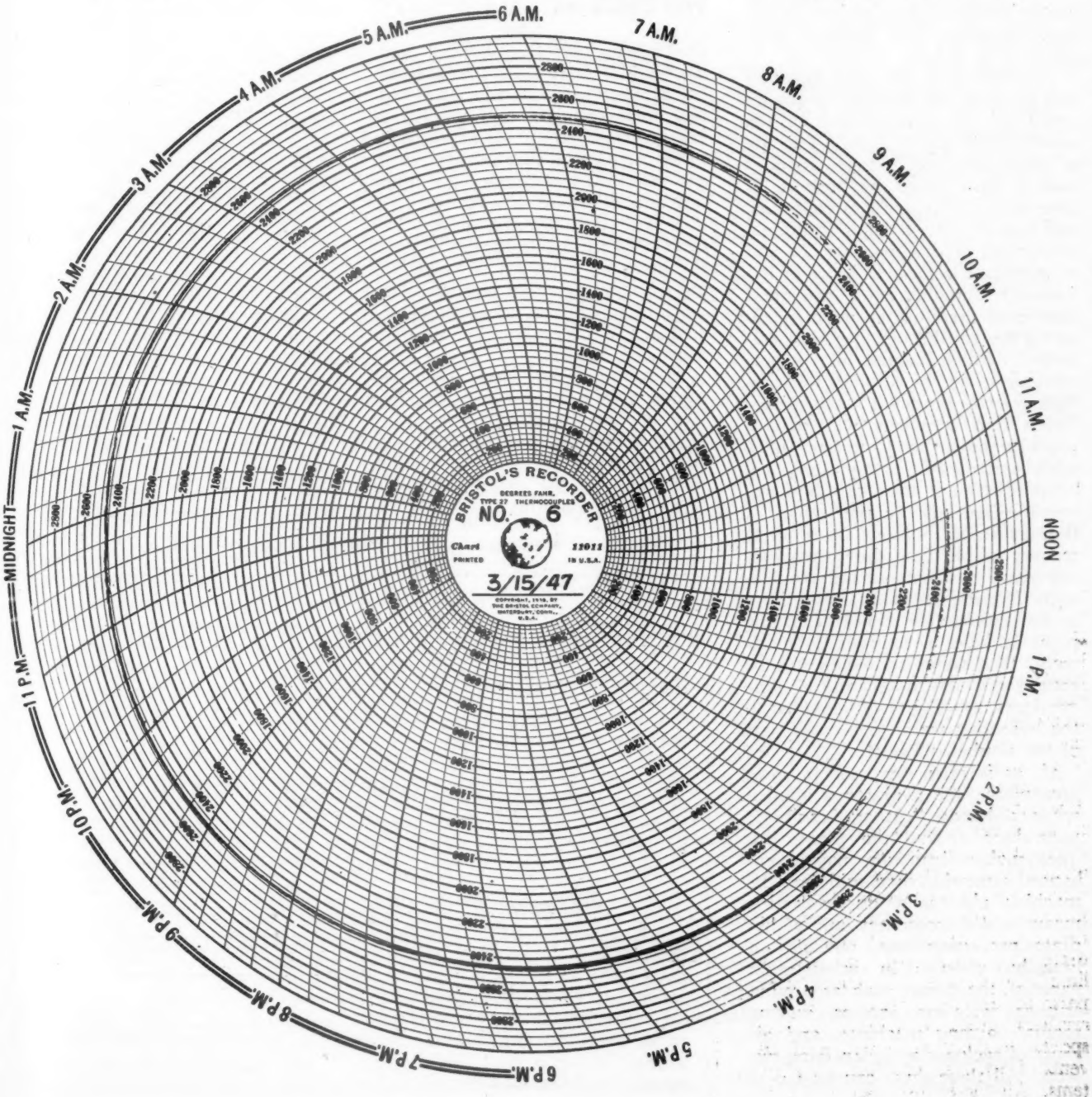
Standard construction is 9-in. firebrick with 4½-in. insulation. A ¼-in. Johns-Manville Transite board face is used over the insulation on the calciner; the balance has a 4-in. common clay brick cover. In the hot zone and on the inner face of the oven 70 percent alumina brick is used. The cooling and preheating zone and other parts of the kiln are lined with No. 1 firebrick.

Carbon-dioxide (CO_2 gas) has never been produced at this plant but tests indicate that the Ellernan Calciner is an excellent producer. One of the several installations now under way will be used basically for this purpose. In order to produce this gas only minor changes in the kiln design are necessary. Hinged hoods are placed over the feed hopper and charging is done periodically to retain the seal. The cooling air circuit is handled by a separate fan which discharges to atmosphere. The undiluted hot exhaust gases are recirculated through the oven for tempering after passing through a cleaner to remove dust in order to get the desired 34 percent CO_2 content.

The limestone used at this plant is not ideally suited for this type of calciner. The stone is a dense, fine-grained limestone containing about 53 percent CaO and 1.2 percent

(*Continued on page* 104)

• Fig. 3. Tempering chamber temperature chart for the 10-ton calciner on March 15, 1947.



THE LIME PLANT OPERATOR

By WOLF G. BAUER

HYDRATION IN THEORY AND PRACTICE

Part VI—Dust Control

ABATEMENT of lime dust in a lime plant which employs no hydrating system is often a difficult and costly job. One reason for this is the fact that lime dust, due to its white color, is a very prominent nuisance, one where a little goes a long way.

Cyclones, both the large-diameter and the more efficient small-diameter types, do not remove much of the minus 40-micron fraction. The use of small-diameter cyclones requires two to three times the pressure of large-diameter centrifugal collectors, and actually only a small additional percentage of dust between 20 and 60 microns is removed. More or less complete elimination of the finest dust must therefore be done by filtering the air through bag dust collectors (which cannot use vapor-carrying dust), or through wet-type high velocity scrubbers and washers. Filters and scrubbers will remove particles down to ½-micron sizes, while electrostatic precipitators will be quite efficient down to sub-microscopic diameters in the range of thousandth of a micron. In order to recover usable lime dust, therefore, expensive electrostatic and troublesome filtering methods would have to be resorted to. However, if the plant includes a hydrating department, then water scrubbing can be employed to advantage, and all lime recovered as sludge can be added to the hydrating water to become part of the finished product.

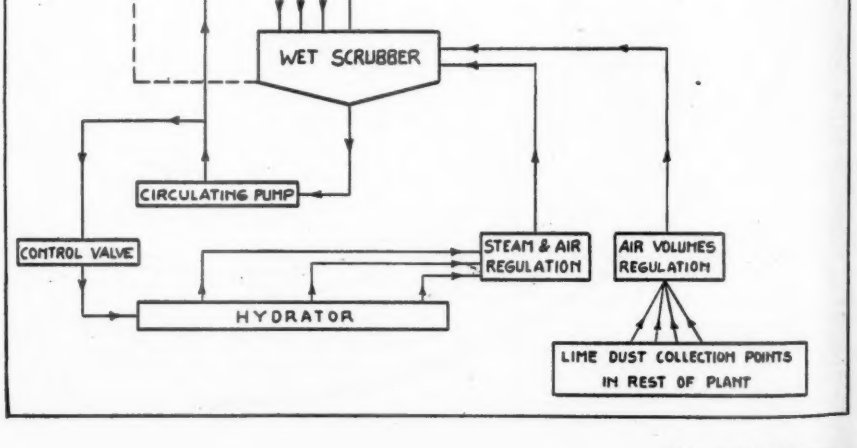
If, as is often the case in some lime plants, the hydrator is alluded to as a handy "garbage can" for poor lime around the plant, this questionable distinction may be enhanced somewhat by considering the machine also as a dust-collecting means and disposer not only of hydrate processing dust, but also of lime dust collected in various other parts of the plant, such as around crushers, grinders, screens, sacking spouts, bagging machines, and air vents of cyclones and classifying systems. All these dusts can be led to a centralized wet dust collection unit integrated with the hydrator operation.

Principles of Wet Collection Moving gases carrying dusts are very much like moving gases containing heat. To transfer heat from gas to solids by convection efficiently and rapidly, turbulency and high gas velocities are required, as we discussed in earlier articles on that subject. High gas velocities increase friction, pressure, and power to move the gas. So it is with dust-carrying gases. The more efficient the collecting system, the more we must pay in power input for creating either high centrifugal dust separation, or impingement of dust and gas on liquid entraining-films and surfaces.

Many operators, and some designers also, have shown a complete lack of understanding of the relationship between gas velocity, gas-path direction changes, and the surface factor of the entraining liquid film. Some operators still labor under the impression that if they atomize a spray of water finely enough, and vent the dusty gas through such a spray counter-currently, the dust can be efficiently removed. True enough, water atomization produces a large liquid surface and impingement area. The forgotten factor, however, is the differential velocity between gas and liquid, and the frictional and impact force that can be exerted between them, for the finer we disperse the water droplets to increase surface area, the lower must the gas velocity be held to prevent both water and dust entrainment.

Fortunately, the problem can be solved efficiently because of the relative ease with which water can be made to flow in thin streams and films over gas and dust impingement surfaces. It remains only to direct the dusty gases against such surfaces at suitable velocities, and within pressure drops that are in line within the power expenditures and collecting efficiencies warranted and required by any installation.

• Hydration and lime plant dust-collection flow sheet.



Draft and Water Requirements Last month we took issue with the practice of adding hydrating water in accordance with the wetness and dryness of the hydrator discharge product. In this article we want to draw attention to the fact that the amount of hydrating water is not necessarily the right quantity for scrubbing the hydrate dust from the exhaust of the hydrator. In fact, if a reasonably clean exhaust is to be achieved, additional water is quite necessary in most instances.

Furthermore, if the necessary wetting surface is provided in the dust collecting stack or system, natural draft by reason of hot steam and air is insufficient to overcome the subsequent impact and eddy losses that are a byproduct of efficient dust removal.

In order to provide ample impingement surface which can be covered by a moving film of water of sufficient depth and velocity to flush the surfaces clean of dust, recycling of the collected milk of lime must be resorted to. This requires a collecting tank, mechanical or hydraulic agitation, milk circulation pump, and automatic float-controlled make-up water valve to regulate for the hydrator requirements.

Hydrator Dust Particle size of hydrate dust may vary from 100 to submicron diameters, the quantity of the coarser fractions depending on the air and steam velocities maintained over the various agitation zones in the hydrator. In most commercial hydrators the dewpoint temperature is not reached until the gases enter the exhaust stack. Before this condensing condition is approached, the hydrate particles behave like dry dust in the steam and vapor, and are readily picked up and carried along as they would be in dry air. At and below the dew point (temperature at which the water vapor or steam condenses to foggy mist, and which is below 212 deg. F. depending on the ratio of vapor and air, and the pressure) the hydrate particles act as nuclei for the condensing vapor, gaining thereby in mass and agglomerating tendencies. This is especially true at the surfaces of the cooler water films against which the dusty gas must be directed. The affinity of a condensate-adsorbed particle of hydrate toward the wetted surface is much greater than that of a dry particle above dewpoint temperature. Hence rapid cooling is desirable. In fact, it is this condensing feature that makes the old-fashioned water-sprayed hydrator stacks seem more efficient than is actually the case.

The dust suspended in water as a milk is readily handled as such if agitation and motion is maintained in the collectors and lines. It is good practice to use a screen or grid between the scrubber and collecting tank, and also to employ long-radius pipe bends instead of standard ells and fittings. The circulating system should be flushed with clean water after each run, and the scrubber itself should be provided with flushing nozzles and connections. Gate valves are preferred over globe valves. Collecting tank bottom should be conical. Water inlet or outlet from the conical bottom can be tangential for swirling agitation during circulation. Figure I gives a flow-sheet arrangement of such a system in its simplest form.

The quantity of water required for scrubbing (i.e. size of scrubber) is a function of the hydrator output and steam generation, the amount of controlling air used in the hydrator, and the quantity of additional lime-carrying air added from other dust-collecting points in the plant. The more water that is circulated, the greater the wetting surface that can be employed.

Gas Handling For a rough estimate we may say that 100 c.f.m. of steam per ton of quicklime per hour will be given off by the hydrator. The amount of cooling and drying air used depends on the machine and process. A fan capacity of 500 c.f.m. per ton of lime per hour at 2 in. to 5 in. s.p. can be considered ample for most cases, the pressure drop depending on the thoroughness of dust collection required, and being, therefore, a function of scrubber design. An additional 1000 to 5000 c.f.m. may be added to take care of lime dust air from other plant points.

The conditioning air used in a stage-controlled hydrator must be varied independently of the scrubber gas velocity requirements. This is another way of saying that the minimum gas velocities for efficient scrubbing must be maintained through the scrubber irrespective of air requirements in the hydrator.

Types of Scrubbers The value of a wet-wall separator over a dry-wall separator lies mainly in the ability of water films to capture very fine particles. When direction of a high-velocity gas stream is suddenly changed, as by impingement and rebound from a surface, entrained particles change direction slower than the gas and concentrate, therefore, near and against the impingement surface. In a dry-wall separator, the finer particles may rebound sufficiently from the surface to be swept away again by the gas current, while the contact with the same surface while wet would result in adhesion and removal of the particles by the flowing water film.

It can be gathered from this brief description that, whereas rotational inertia is relied upon in dry-wall separators, to cause particles to be thrown out of the gas stream or vortex, only change in direction through direct impingement is required to force particles into the water film or onto the surface of the water film, and so cause capture.

Rotational or vortex-type gas paths are employed for two reasons, one, to lengthen the gas path and separation time within a given collector space, and, secondly, to apply centrifugal loading on the particle, and with the least pressure conversion losses in changing from velocity to static energy. We can, therefore, arrive at a combination design of wet centrifugal collector in which only additional wet impingement surface needs be provided. With a little engineering it is well within the means of the small plant and shop to construct their own wet collector for their hydrator or plant needs. In connecting such scrubbers to the hydrator it should be kept in mind to maintain the gases above the condensation temperature until they pass into the scrubbing zone. This can be accomplished by placing scrubber inlets close to the hydrator, and also insulating the connecting ducts.

For those plants which can afford to invest in a complete wet scrubber installation, there are several types which have been used quite successfully on hydrator exhausts, as well as on kiln waste gases and other dusty plant outlet vents. In the American Air Filter Co. static Rotoclone, high impingement and wetting of dusty gases is achieved by inducing a curtain of water through a figure-S slot. In the scrubber by Schmieg Industries, the curtain of water thrown against the impingement baffles is created by revolving drums partly submerged in the collecting water. The Schneible scrubber employs centrifugal impingement action and fairly heavy re-circulation of scrubbing water, and has been used with good results on hydrators.

Aside from these stationary or

(*Continued on page* 106)

AGSTONE DIVISION OF PENNSYLVANIA STONE PRODUCERS MEETS IN HARRISBURG

another P-Q exclusive

THE value of crops produced on three types of soil very common in northern and central Pennsylvania can be approximately doubled by applications of lime, according to a statement made by J. W. White, research worker at the Agricultural experiment station, Pennsylvania State College, in addressing the recent Annual Meeting of the Agricultural Limestone Division of the Pennsylvania Stone Producers Association. This meeting was held March 24, 1947, at the Penn Harris Hotel, Harrisburg, Pa.

On the less acid Hagerstown soil found at the station, trials with corn, oats, wheat, and hay over a 70-year period have shown liming to increase the value of crops by 25 to 50 percent.

Preliminary results of research indicate that yields of corn hybrids vary in response to fertilizers, A. C. Richer, soils technologist, pointed out. As the planting rates of corn increase and competition between individual plants becomes keener, the protein content of the grain drops sharply. Part of this decline can be overcome by fertilization.

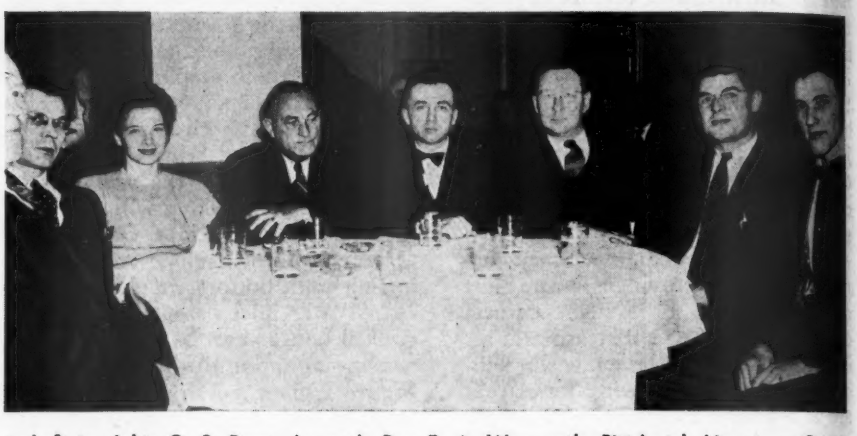
Dr. H. K. Wilson, vice-dean of the School of Agriculture, also spoke, and said that many unproductive pastures can be made highly productive by reseeding and the periodic application of moderate amounts of fertilizer.

During a business meeting for the membership only, a general discussion was held on the merits of the contract system versus the purchase order method of making liming materials available to the farmers of Pennsylvania, with the consensus of opinion equally divided.

The following officers were elected for the ensuing year:

Chairman, F. E. Wholaver, secretary-treasurer, Whiterock Quarries, Bellefonte, Pa.; vice-chairman, Paul I. Detwiler, New Enterprise Stone & Lime Co., New Enterprise, Pa.; treasurer, Ellwood Gilbert, president, New Castle Lime & Stone Co., New Castle, Pa.; secretary, H. H. Wagner, general manager, Pennsylvania Stone Producers Assn., Harrisburg, Pa.

The Pit and Quarry Directory lists all the important nonmetallic minerals producers, both alphabetically and geographically. It is distributed free only to those listed in it. To all others the price is $15.00 per copy.



• Left to right: G. S. Ruoss, Leacock, Pa.; E. A. Weymouth, Pittsburgh Limestone Corp., Pittsburgh, Pa.; Shirley T. Aungst, Agricultural Limestone Div., Pa. Stone Producers Assn., Harrisburg, Pa.; Ellwood Gilbert, president, New Castle Lime & Stone Co., New Castle, Pa., and treasurer, Agricultural Limestone Division; I. M. Martin, Blue Ball, Pa.; C. W. Meyer, Bradley Pulverizer Co., Allentown, Pa.; C. S. Good and D. M. Burkholder, Ephrata, Pa.; and L. M. Hoover, Bareville, Pa.

• Left to right: F. E. Wholaver, secretary-treasurer, Whiterock Quarries, Bellefonte, Pa., and chairman of the Division; K. O. Brown, New Castle Lime & Stone Co., New Castle, Pa.; W. C. Curtin, Warner Co., Bellefonte, Pa.; C. A. Zehner, state director, Production & Marketing Adm., Harrisburg, Pa.; J. B. Whittaker, American Cyanamid Co., Harrisburg, Pa.; C. E. Peterson, Pine Creek Lime & Stone Co., Jersey Shore, Pa.; and H. L. Manwaring, U. S. Department of Agriculture, Washington, D. C.

• Left to right: C. T. Burton, American Cyanamid Co., Pittsburgh, Pa.; H. M. Binkley, Binkley Bros. & Ober, East Petersburg, Pa.; Harold Poorman and L. B. Smith, Inc., Camp Hill, Pa.; J. P. Peacock, Bethlehem Steel Co., Bethlehem, Pa.; Richard Evans, Evans-Roberts, Inc., Norristown, Pa.; H. W. Lynn, Bethlehem Steel Co., Steelton, Pa.; Carl Beckler, Bethlehem Steel Co., Bethlehem, Pa.

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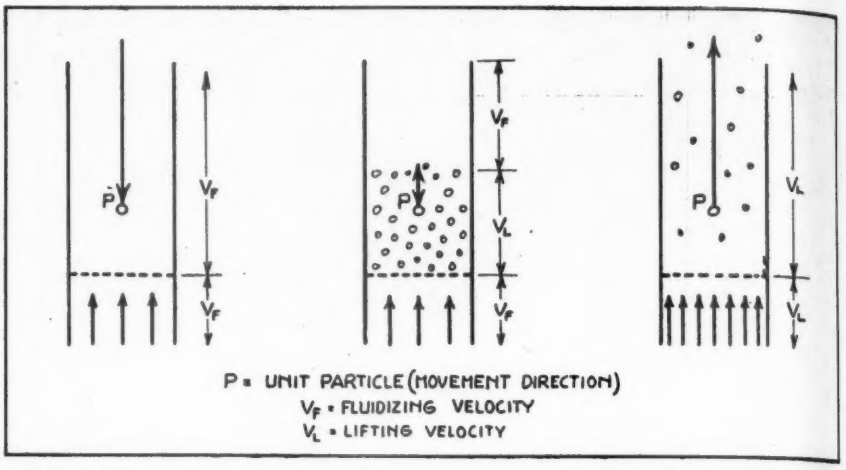


Fig. 4. Relationship of fluidizing-to-lifting velocity.

Fluidization

(*From page* 94)

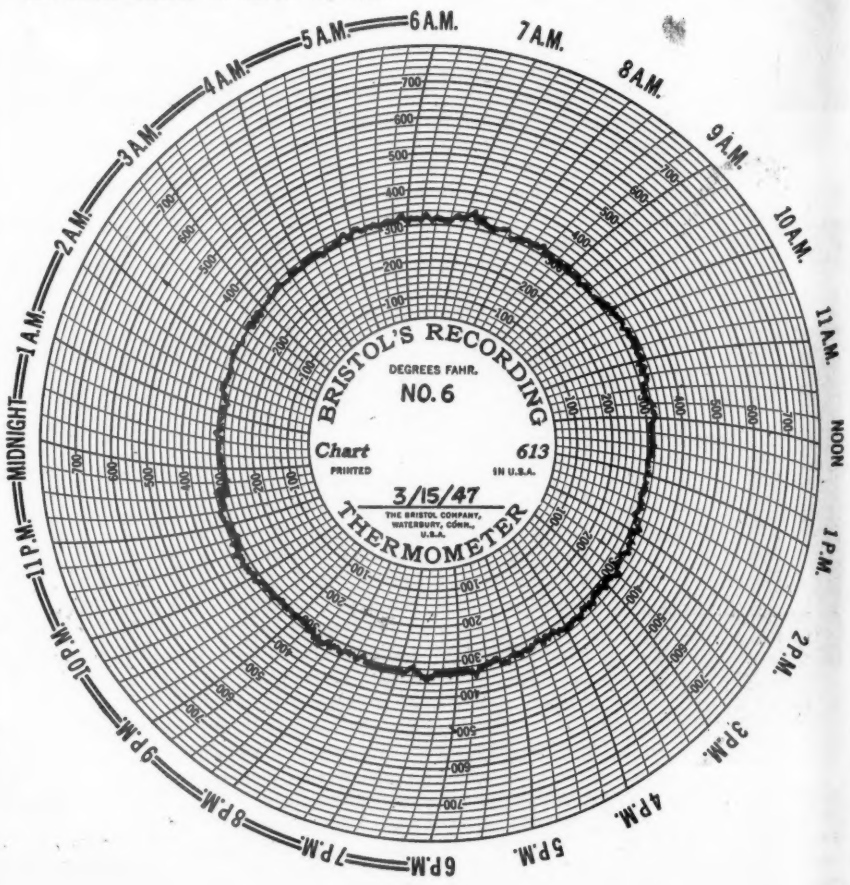
represented by a horizontal line X, Y_1, between the flow and lifting curves, we must keep velocity constant; while at the other extreme, if we had minimum or zero particle size range, as represented by a vertical line X, Y, between the two curves, we would achieve a maximum range of velocities from low level to high level fluidization. In practical application this would mean that, if we needed to change our gas velocities in a process, we would have to narrow the particle size range, and our connecting line X, Y_2 would then have some positive slope from X to Y_2, the slope determining whether range in fluid velocities or in particle size was to be the most important variable of the particular fluidization system.

Calciners Set New Records

(*From page* 99)

MgO. It breaks up into flat slabby pieces with a low void content which do not handle or burn as efficiently as a more cubical stone. These original calciners, which are producing 5 and 10 tons daily at this plant, are smaller than the standard calciners which will produce 6 and 12 tons daily.

• Fig. 4. Exhaust gas temperature chart for the 10-ton calciner on March 15, 1947.



This stone is quarried and sized at the company's crushed stone and agstone plant and is hauled about 2 miles to the lime plant. There it is rescreened and cleaned over a Simplicity vibrating screen before it is discharged from skip cars into the kiln-feed bins. These cars are to be replaced by a conveyor. The kiln-feed bins hold enough stone for 36-hours operation. J. T. Ellerbeck is general superintendent of all operations.

Lime Plant Operator

(*From page* 101)

static-type scrubbers, the use of especially-designed dynamic or rotating wet scrubbers can be employed, and can be adapted readily to this work. Fundamentally these are not different from centrifugal wet-wall cyclones except for the fact that the gas vortex is created by a fan-type wheel instead of a high-velocity tangential gas entry to the circular chamber. Water is sprayed against the blading which is closely spaced for maximum surface. The sludge is drained out continuously at the discharge end of the scroll collector. It can be seen that such dynamic centrifugal scrubbers combine the function of a dust collector with that of an exhauster. Such spray

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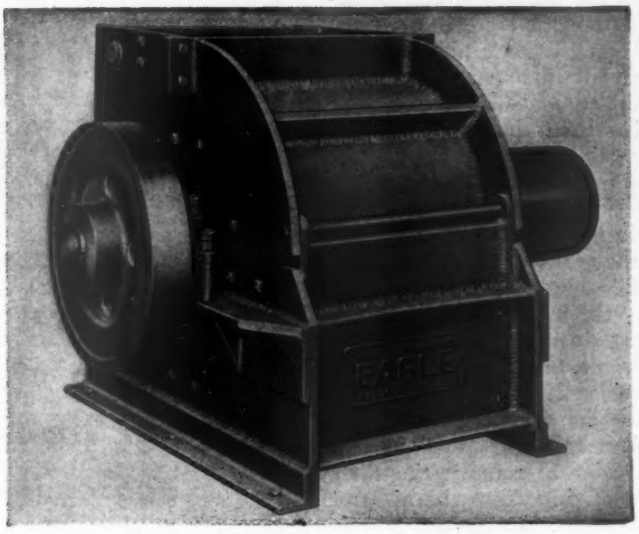

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and scrubbing provisions can be arranged for several types of common fans, and these considerably enhance and augment the efficiency of a plant-designed wet-wall collector.

In review then, the following facts may be established.

1. The use of extra heat and drying facilities presented by a hydrator allows all lime dust in the plant to be recovered as a saleable product by scrubbing the hydrate dust with the plant dust in a common wet collector, and at the same time provide the hydrator with a processing steam and air control means.
2. In order to remove the finer sizes of dust from the air and vapor (i.e. sizes below 50-micron diameters), scrubber design should feature high-impinging gas velocities directed against maximum wet-film surfaces washed by an ample quantity of circulating water that is independent of hydrator needs.

(To be continued)

Complete but condensed information on nonmetallic minerals production is contained in the statistics chapter of the Pit and Quarry Handbook.

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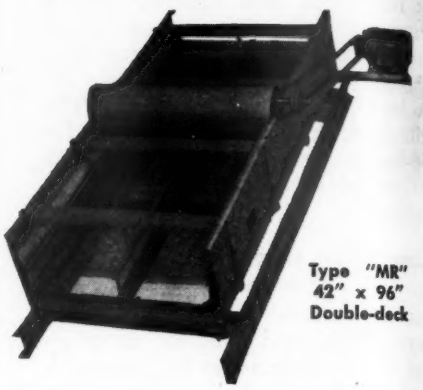

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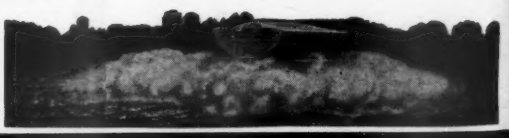

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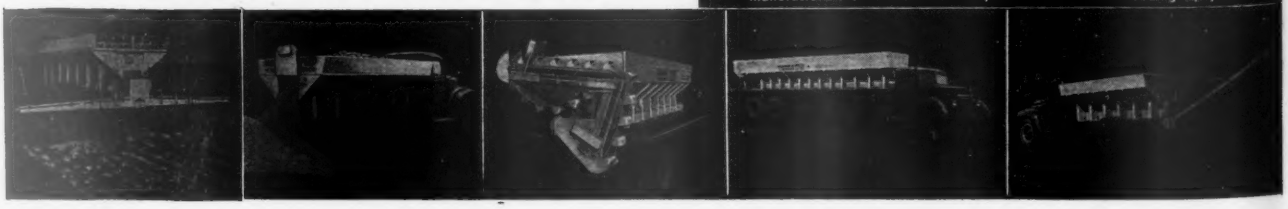


A.I.M.E. 75th Anniversary Celebrated At Annual Meeting

By WILLIAM M. AVERY

another ON THE SPOT report

THE 75th anniversary celebration and the 164th general meeting of the American Institute of Mining and Metallurgical Engineers were held consecutively during the week of March 17 to 22 at the Waldorf-Astoria Hotel in New York City. A World Conference on Mineral Resources, held in conjunction with the meeting, gave a definitely international flavor to the proceedings, and attracted delegates and visitors from every corner of the globe.

Distinguished speakers addressed the Conference on such timely subjects as international aspects of the petroleum industry of the future, the effect of economic changes on world coal reserves, the philosophy of international atomic energy control, application of atomic energy to industry, and techniques of mineral exploitation of the future.

Mineral Exploitation In his discussion of mineral exploitation techniques of the future, Louis Shattuck Cates, retiring president of the A. I. M. E., referred to the increased safety and efficiency of improved mining methods involving the use of diamond drills for blast hole drilling. "Recent improvements," he said, "in drill bits by furnishing hard metal cutting edges on small bits and the apparent increase in the range of drill footage, together with the decrease in the size of the rock drills used, make it interesting to speculate upon the application of tungsten carbide bits in percussion drills to the long-hole blasting methods developed by diamond drilling. It appears that under some conditions more footage per drill shift may be drilled with light jackhammer-type machines mounted on a jumbo and using hard metal bits than with diamond drills."

Mr. Cates made reference to a process, still in the development stage, of fusion-piercing for blast holes.* He said that tests to date indicate that the technique may be successfully applied in fusing vertical blast holes through extraordinarily hard rock.

In reviewing some of the improvements in metallurgical practices and equipment which have helped keep many mineralized areas in production, Mr. Cates mentioned particularly the Humphreys Spiral, which he believes is the most revolutionary development in the field of gravity concentration since the invention of the shaking table and the application of sink-float. He mentioned an application in which the Humphreys Spiral is being used to make a preliminary concentrate from a large lead-zinc tailing dump. Capable of treating 5,000 tons of material per day, the installation occupies an area measuring only 80 by 112 feet, and it can be operated with only three men per shift. Tests indicate that the Humphreys Spiral may be used in recovering and upgrading any material which can be benefited by low-cost gravity separation.

A considerable portion of Mr. Cates' paper, which was prepared in collaboration with Howland Bancroft, mining consultant, was devoted to aluminum and magnesium and their alloys. Mention was made of the Alcoa Combination Process as being the most notable advance in the beneficiation of bauxite in recent years. This new process, which operates in conjunction with the standard Bayer Process, recovers

*See (Trauffer, W. E.): *Oxy-Acetylene Drilling Expedites Production of Flint Grinding Pebbles.* PIT AND QUARRY, April, 1944, Pages 68-70—THE EDITOR.

• Scene at the 75th anniversary banquet of the American Institute of Mining and Metallurgical Engineers.

most of the alumina and soda from the Bayer waste by controlled sinter technique.

Mr. Cates predicted that the two light metals, aluminum and magnesium, will inevitably move into serious competition with steel in American industrial development.

Following the World Conference on Mineral Resources, more than 200 scientific papers and reports were presented in the annual technical sessions held at the Waldorf, the Pennsylvania Hotel and the Engineering Societies Building. Under suitable headings, papers of particular interest to producers of nonmetallic minerals are briefly reviewed in these pages.

DRILLING AND BLASTING

In a paper entitled *The Development of a Successful Hard-Surfaced Bit for Drilling Oil Shale,* Tell Ertl, John R. Wagner, Jr., and Ernest E. Burgh, all of the Bureau of Mines, presented a progress report on the Bureau's findings in connection with efforts to develop economical methods and practices for mining oil shale on a commercial scale. Mining research in connection with the Bureau's oil-shale demonstration plant at Rifle, Colorado, has been confined largely to problems associated with drilling.

Hard Surfacing Since unusually low mining costs are necessary for commercial production of shale oil, hard surfacing of rock bits was tried in order to reduce non-productive time in changing drill rods, replacing worn bits and shifting the position of the drill. Acetylene Tube Borium, manufactured by Stoody Company of Whittier, California, was used for the hard surfacing, and the technique has now progressed to the point where good bits can be produced consistently. Preparation consists of grinding the cutting edge flat to a distance of 1/16 inch from the original edge toward the seat of the bit, and by grinding the reaming points at an angle of 45 degrees to the cutting edges to a depth of 3/16 inch measured from the original reaming points toward the seat of the bit. Fig. 1 shows a prepared bit and Fig. 2 shows a bit after the head of hard-surfaced material has been welded to the prepared cutting edges and reaming points.

The welding is done with an acetylene torch using a Smith No. 72 welding tip. After the hard surfacing has cooled the bits are ground to their original size and shape with an emery wheel. Heat treating is done by heating the bit for ½ hour at a temperature of 1,450 degrees F. and quenching in water at room temperature until all color has left the seat of the bit. The retempered bit is stress relieved by reheating to 300 degrees F. for a period of an hour.

Standard bits in oil shale had been found to require resharpening after drilling only 5 feet of hole. If used longer than this, serious difficulty was encountered with sticking, and more than ⅛ inch of the original gage had to be removed in resharpening. Although the cutting edges lost little of their original sharpness, the reaming points were rounded after 5 feet of drilling, and the bits showed extensive loss of gage.

It was found that with the hard-surfaced bits 100 feet of hole could be drilled without failure, loss of gage, or reduction in drilling speed. Only in the range of 200 feet did speed of drilling show a marked reduction, and gage loss after 200 feet was within the limits of 1/64 to 1/32 inch.

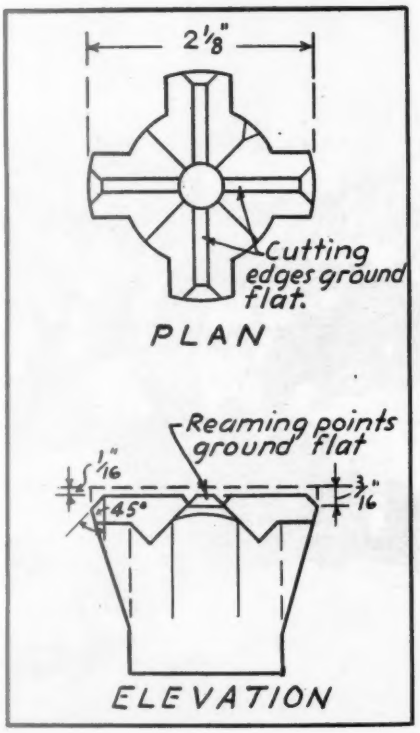
The direct bit cost of the hard-surfaced bits was found to be about ¾ cent per foot of hole drilled, or approximately ¼ the cost incurred with standard bits. In addition to important time savings in the actual drilling operation, the use of hard-surfaced bits seems to result in increased explosive efficiency. The constant diameter of the hole drilled with this type of bit makes it possible to load a larger percentage of the charge in the bottom.

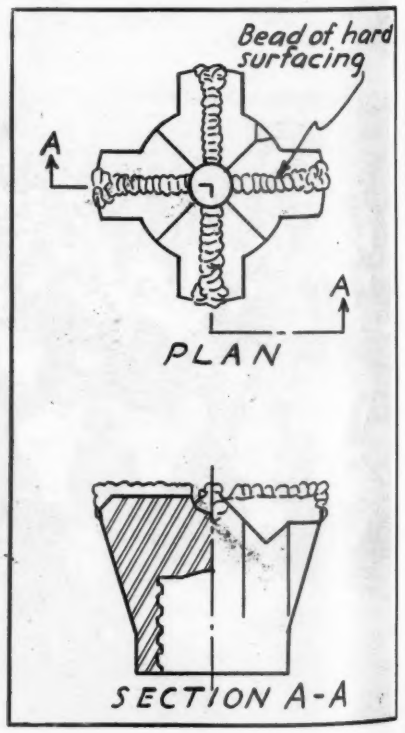
It is thought that with minor modifications the hard-surfaced bit may prove to be suitable for use in hard, brittle rock. Performance in the tough, but relatively soft, oil shale indicates that it can be used in many types of softer rocks, such as limestone.

Shaped Charges An entire session was given over to a discussion of shaped charges, a relatively new development which has grown out of the successful use during the war of fixed shape charges to assault pillboxes and other concrete emplacements.

In his paper *Studies of the Design of Shaped Explosive Charges and Their Effect in Breaking Concrete Blocks,* George B. Clark, assistant professor of mining engineering, University of Illinois, discussed some of the basic principles of the functioning of shaped charges. Results of experiments conducted by Mr. Clark at the University of Utah indicate the following:

1. That a given design of charge requires an optimum standoff to make it most effective in pentrating either solid rock or steel.
2. For a given design of charge there exists an optimum ratio of charge diameter to charge height above which the increase in effectiveness of the charge decreases rapidly.
3. Partial confinement results in much more consistent charge performance.





• Fig. 1. Left: Bit prepared for application of hard-surfacing.
• Fig. 2. Right: Bit with bead of hard-surfacing applied.

4. Higher power and higher velocity explosives are more effective than relatively low-strength explosives.

5. Shaped charges may be adaptable to mining operations in secondary breakage and drilling blast holes.

Fig. 3 shows diagrammatically the mechanism of the jet formation in shaped charges with hemispherical and conical cavities. In experimenting with a number of different metals for the cavity liners, Mr. Clark found indications that brittleness is one of the desirable characteristics. An aluminum alloy, with a higher tensile strength than any of the other metals tested, gave the best performance.

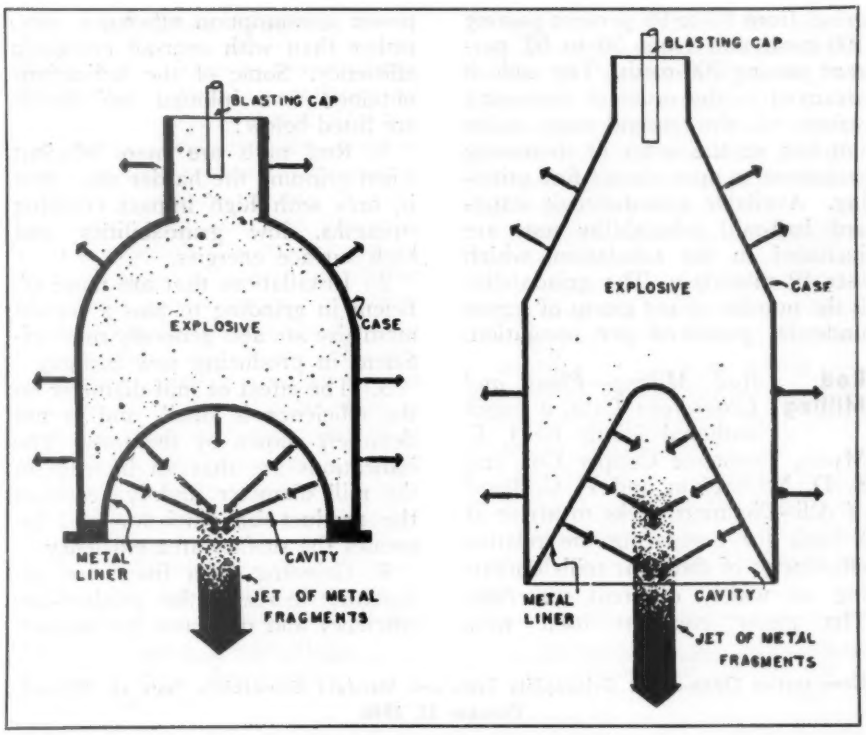
Shrapnel from metal cases would undoubtedly constitute a serious safety hazard in open-pit operations. Mr. Clark has experimented with concrete cases made of portland cement and fine sand with a fiber binder, but results have not been too satisfactory.

Mr. Clark carried out breakage tests on three sets of graded sizes of concrete blocks, using 2-in. hemispherical charges with aluminum-alloy liners and aluminum cases. The various charges were loaded with 100 percent blasting gelatin, 60 percent N. G. dynamite and 45 percent Gelamite. For any particular size of block (the units ranged from 12 to 18 inches in depth, and from 12 by 12 to 36 by 36 inches in area), the 100 percent blasting gelatin was most effective, indicating that the possible breaking power of the jet is assisted considerably by the impact blow of the shock wave.

Churn Drills In a session devoted to the subject of borehole drilling, J. R. Thoenen of the Bureau of Mines and E. J. Lintner, mining engineer, submitted a progress report on churn drill performance based on tests carried on by the Bureau of Mines at a number of stone quarries throughout the country. Essentially a crusher, the churn drill depends for its performance on the foot-pounds of energy it can impart to the cutting edge of its bit. The following conclusions regarding churn drill performance were mentioned in the report as "tentative":

1. Drill performance decreases with elapsed time in general, but there are enough exceptions to justify further study.

2. Available data were insufficient to compare type of cable used with drill performance. The tests indicated, however, that performance characteristics for steel and manila cable differ radically.



• Fig. 3. Sketches of shaped charges with hemispherical (left) and conical (right) cavities, showing the mechanism of formation of Monroe jet.

3. The specific gravity of the drill sludge should be about 70 percent of the specific gravity of the rock being drilled for optimum results.

4. Lengthening of the stroke seems to improve initial performance, but with elapsed time the drilling rate equalizes regardless of stroke length.

5. Performance improves with increase in tool weight up to an indicated optimum weight per inch of bit diameter. Beyond the optimum, added weight has little effect.

6. A change in the number of strokes per minute or drill speed has only minor effect on performance.

7. Volume drilled and efficiency increase with increase in bit diameter up to an optimum beyond which added diameter has no effect. However, linear hole drilled varies inversely with bit diameter.

8. The angularity or sharpness of the cutting edge of the drill bit has only a minor effect on drill performance.

9. Exclusive of drill mechanism and power unit, the mechanical efficiency of a churn drill seldom if ever exceeds 20 percent and will probably average nearer 10 percent.

Many of the data included in the report were obtained over a period of several months at Consolidated Quarries Corp., Lithonia, Ga., where exceptionally uniform rock was available. In order to eliminate as many variables as possible, a single Model 84 Keystone drill (skid-mounted) was used at this location.

GRINDING

Standard Tests *Standard Grindability Tests Tabulated* was the subject of a paper by Fred C. Bond, Director of Allis-Chalmers' Basic Industries Research and Testing Laboratory. The lists of standard ball-mill and standard rod-mill grindability tests are brought up to date, and new material is added, including a tabulation of open-circuit grinding tests, impact and compression tests, and preliminary data on abrasion tests.

Particularly interesting to PIT AND QUARRY readers is the report of open-circuit grindability tests which have not been published previously. Although these tests have been made for more than 30 years at the Allis-Chalmers laboratory, the grinding indices have been calculated only for tests made within the last two or three years. Most of the materials tested in open-circuit grinding are portland cement raw materials, clinker or limestone.

The tests are concerned with open-circuit wet and dry grinding in two stages. The grinding index (see table on p. 124) for the first stage is the average of the number of revolutions required to grind from 25 to 95 percent passing 10-mesh and from 20 to 85 percent passing 20-mesh. The index for the second stage is the average of the number of revolutions required to

grind from 60 to 99 percent passing 100-mesh and from 50 to 92 percent passing 200-mesh. The table is arranged in the order of increasing values of the second-stage index number, or the order of increasing resistance to open-circuit fine grinding. Available closed-circuit standard ball-mill grindability tests are included in the tabulation, which lists 49 materials. The grindability is the number of net grams of screen undersize produced per revolution.

Rod Milling *Rod Milling—Plant and Laboratory Data,* a paper authored jointly by J. F. Myers, Tennessee Copper Co., and S. D. Michaelson and F. C. Bond of Allis-Chalmers, seeks to arrive at a basis for comparing the relative efficiencies of different mills operating on widely different materials. The paper concerns itself with power consumption efficiency only, rather than with over-all economic efficiency. Some of the indications obtained from plotted test results are listed below:

1. Rod mills are more efficient when grinding the harder ores; that is, ores with high impact crushing strengths, low grindabilities and high surface energies.

2. Installations that are more efficient in grinding to pass a certain mesh size are also generally more efficient in producing new surface.

3. The effect of mill diameter on the efficiency is small, and is not definitely shown by the tests. The indications are that an increase in the mill diameter slightly decreases the product-size efficiency and increases the surface-area efficiency.

4. Grinding to a finer size apparently increases the product-size efficiency and decreases the surface-area production efficiency. The trends, however, are too small to be conclusive.

5. An increase in the reduction ratio on the installations tested apparently does not affect the product size efficiency and slightly decreases the surface-area production efficiency.

6. The mill speed of the installations tested apparently does not affect either the product-size or surface-area production efficiency.

7. An increase in the mill volume also apparently does not affect the product-size efficiency and the surface-area production efficiency.

8. Surface-area production efficiency is less affected by the mill-operating variables than the size production efficiency, although the latter is probably of more immediate concern to mill operators.

Comparative Open-circuit Grindability Tests and Standard Grindability Tests at 200-mesh, October 23, 1946

Open-circuit Tests

First Stage (I) Large Ball Mill			Second Stage (II) Trojan Jar Mill		
Mesh	Limits	Rev.	Mesh	Limits	Rev.
10	25–95		100	60–99	
20	20–85		200	50–92	
	Average			Average	

Standard Closed-circuit Grindability Tests Made at 200-mesh

Test No.	Name and Location	Wet or Dry Grind	Material	Grindability, 200-mesh	Index I[a]	Index II[a]
1652	Iraq Cement Co., Bagdad, Iraq	Wet	P. C. mix	3.51	878.0	2812.0
1316	Cementa del Caribe, Barranquilla, Colombia	Wet	Limestone		1049.0	2938.0
1448	Cemento del Caribe, Barranquilla, Colombia	Wet	Limestone		862.0	3187.0
1642	Cia de Cemente Portland Diamente, Colombia	Wet	Limestone	1.04	2026.2	3245.0
1492	Fabrica del Cemento Samper, Bogota, Colombia	Wet	P. C. mix		1612.5	3312.0
1715	HWA-HSIN Cement, Shanghai, China	Dry	P. C. mix	1.37	1900.0	3397.0
1600	La Cruz Azul, Jasso Hgo. Mexico	Wet	P. C. mix		1732.0	3545.0
1590	Calavaras Cement Co., San Francisco, Calif	Wet	Limestone	1.66	1245.0	3625.0
1114-A	North American Cement Corp., Alsen, N. M	Wet	Limestone		1631.2	3750.0
1585	Fabrica del Cemento Samper, Bogota, Colombia	Wet	P. C. mix		4850.0	3875.0
1656	Missouri Portland, St. Louis, Missouri	Wet	P. C. mix	2.06	1048.0	3916.0
1605	Halliburton, Caracas, Venezuela	Wet	P. C. mix	1.29	1637.0	4002.0
1518	Cemento Panama, Cristobal, Panama	Wet	P. C. mix		470.0	4050.0
1114-A	North American Cement Corp., Alsen, N. Y	Wet	Limestone		1737.5	4062.5
11-34	Universal Atlas-Leeds, Alabama	Wet	P. C. mix		1642.0	4130.0
1715	HWA-HSIN Cement Co., Shanghai, China	Wet	P. C. mix		1900.0	4187.5
1545	Universal Atlas—Northampton, Penn	Wet	P. C. mix	1.71	1287.0	4218.0
1529	Cemento del Caribe, Barranquilla, Colombia	Wet	P. C. mix	2.47	819.0	4371.0
1529	Cemento del Caribe, Barranquilla, Colombia	Wet	P. C. mix	2.37	787.0	4413 0
1114-A	North American Cement Corp., Alsen, N. Y	Wet	Limestone		2550.0	4487.5
1345	Missouri Portland, Prospect Hill, St. Louis	Wet	Limestone	2.68	1200.0	4625.0
1180-A	Union Portland Cement, Devils Slide, Utah	Wet	Limestone		2281.2	4625.0
1318	Missouri Portland, Memphis, Tenn	Wet	P. C. mix	1.39	1042.0	4637.0
1114-A	North American Cement Corp., Alsen N. Y	Wet	Limestone		2068.5	5187.5
1189-A	Kelly Island Lime & Transport Co., Ohio	Wet	Limestone II		450.0	5825.0
1190	Lone Star, Nazareth, Penn	Wet	Limestone		1975.0	6500.0
1189-A	Kelly Island Lime & Transport Co., Ohio	Wet	Limestone I		475.0	7062.5
1134	Universal Atlas—Leeds, Alabama	Dry	PC clinker		1979.0	7625.0
1670	Cementos Del Valle, Cali, Colombia	Wet	P. C. mix	0.95	1888.5	7662.5
1618-B	Cementos Guadalajara, Jalisco, Mexico	Dry	PC clinker		1942.9	7875.0
1698	Magnesium Do Brazil Ltda., Rio De Janiero	Dry	"ORO"	1.74	737.5	9375.0
1698	Magnesium Do Brazil Ltda., Rio De Janiero	Dry	"NEG"	1.62	807.7	9875.0
1795	Carlos T. Novella & Cia., Managua, Nicaragua	Dry	P. C. mix		1545.0	10375.0
11-34	Universal Atlas—Leeds, Alabama	Dry	Clinker		1703.0	14250.0
1267	Penn.—Dixie, Richard City, Tenn	Dry	Clinker I		1435.0	16375.0
1618-A	Cementos Guadalajara, Jalisco, Mexico	Dry	P. C. mix		1900.0	16750.0
1222-A	Louisville Cement Co., Speed, Indiana	Dry	Clinker		2143.7	17500.0
1267	Penn.—Dixie, Richard City, Tenn	Dry	Clinker II		1749.0	19000.0
1609	Santa Cruz P. C. Co., San Francisco, Calif	Dry	Clinker		1692.2	20000.0
1114-A	North American Cement Corp., Hagerstown, Md.	Dry	Clinker II		1575.0	20500.0
1636	Riverside Cement Co., Oro Grande, Calif	Dry	P. C. mix	1.56	1512.5	20625.0
1519	Lawrence Portland Cement, Thomaston, Me	Dry	Clinker		1887.5	24125.0
1590	Calavaras Cement Co., San Francisco, Calif	Dry	Clinker		1456.0	24500.0
1618-B	Cementos Guadalajara, Jalisco, Mexico	Dry	Clinker		988.7	24750.0
1114-A	North American Cement Corp., Hagerstown, Md.	Dry	Clinker I	0.924	2087.5	27875.0
1180-A	Union Portland Cement, Devil's Slide, Utah	Dry	Limestone		2950.0	28875.0
1617	Consolidated Portland Cement, Cement City, Mich	Dry	Clinker	0.87	1126.0	31312.5
1795	Carlos T. Novella & Cia., Managua, Nicaragua	Dry	PC clinker		1656.0	37875.0
1114-A	North American Cement Corp., Alsen, N. Y	Dry	Limestone	1.15	3437.5	44125.0

a Indices I and II equal the average revolutions required between the limits shown.

SINK-FLOAT CONCENTRATION

Separating Vessel E. C. Bitzer of the Colorado Iron Works reported on the results obtained in an effort to simplify the equipment in the separating circuit of the heavy-media process by substituting a spiral classifier for the separating cone. Commercial operations on both iron and zinc ore indicate, according to Mr. Bitzer, that the spiral classifier has both mechanical and metallurgical advantages over any type of separating cone for treating feed that contains large amounts of material of a specific gravity close to that of the separating medium.

The author points out that two distinct grades of concentrate can be produced with the spiral separator —a middling which floats and a heavy sink of high grade. In the work described both products had to be ground to flotation size for final concentration, and there was accordingly no advantage to be gained by recovering the products separately. The possibility of separate recovery suggests to Mr. Bitzer that a separation of fluorspar might be made in which the tailing could be rejected, the middling sent to final grinding and flotation, and heavy concentrate marketed directly.

Galena vs. Ferrosilicon In his paper *Comparison of Galena and Ferrosilicon in Heavy-Media Separation,* E. H. Crabtree, Jr., chief metallurgist, Eagle-Picher Mining & Smelting Co., compares operating results and costs of operation of the two media. His company treated about 7,500,000 tons of lead-zinc ore using galena concentrate from the flota-

tion plant as the sink-float medium. Subsequently minus 100-mesh ferrosilicon was substituted for the galena, and has been used in the treatment of more than 5,000,000 tons of ore.

In his summary Mr. Crabtree states that the use of ferrosilicon as a substitute for galena has proved worth while, especially in view of results obtained in recent months. Operating costs and grade of tailings for the two media have been approximately equal, but with ferrosilicon the grade of cone concentrate is materially higher, and the cost of fine-grinding the cone-concentrate for flotation treatment is correspondingly less. In addition, the lead content of the flotation zinc concentrate has been reduced. Because of the greater ease with which the ferrosilicon medium can be cleaned, better treatment of muddy ores has been possible.

GENERAL MILLING SYMPOSIUM

Convevor-Belt Operation During the course of a general milling symposium, Melvin C. Dow, chief engineer of the New York Trap Rock Corp., presented a paper reviewing some of his company's findings with respect to conveyor-belt operation and maintenance. Pointing out that the cost of belt wear alone may run as high as 1½ cents per ton of material produced, Mr. Dow stated that there are boundless opportunities for increasing belt life and effecting worth-while savings. Alignment and loading are among the critical factors which have an important effect upon belt performance. Feeding at right angles, with resulting turbulence and impact, and loading belts on an incline were mentioned as conditions to be avoided.

Mr. Dow is particularly opposed to the practice of installing skirt boards to reduce spillage without careful advance study to determine the actual source of the trouble. Often the real trouble may be in the loading chute, and poorly-designed skirt boards, thrown together with scrap materials, may serve only to conceal a major source of excessive belt wear.

By means of careful original design, strict attention during operation, and the keeping of complete and accurate performance records, Mr. Dow is satisfied that the useful life of any conveyor belt can be prolonged materially.

GENERAL SESSION

Stone By-Products Nelson Severinghaus, general manager of Consolidated Quarries Corp., reviewed the progress made in recent years in the utilization of by-products of crushed stone operations. He described his company's experience with the use of hydraulic-type classifiers to remove dust from fines in order to produce an acceptable material for the concrete products industries. This development made it possible for the company to market 130,000 tons of concrete sand last year from what were formerly regarded as waste piles. The process also makes it possible to take off a range of sizes for various uses.

Mr. Severinghaus also referred briefly to initial experiments now in progress to determine the role of fine insoluble stone in plant growth. If the tests should indicate that soil chemistry does actually make the chemicals available for plant growth, farm use may some day provide an important outlet for the so-called insoluble rocks.

Monument quarries, according to Mr. Severinghaus, are now marketing man-sized stones, splayed from larger unusable blocks, for use in retaining walls and foundations, and a number of quarries which formerly dealt exclusively in dimension stone are now finding their major outlet in chicken grits.

The conclusion he draws is that in the next few years the huge waste piles associated with stone crushing activities may become a thing of the past.

Potash Mining Restrictions Lifted to Spur Production

Liberalization of restrictions on potash prospecting was recently announced by the Department of the Interior, whose staff look to the change in policy as one means of increasing the production of fertilizer. The following changes in regulations of the Bureau of Land Management were made public:

1. Potassium prospectors may obtain permits to work as much as 25,600 acres of the public domain, in addition to 15,360 acres which may be leased.
2. The U. S. government will reserve the right to purchase one-tenth of the potash produced under a lease. (Previously the government claimed one-fourth of production.)
3. No detailed information is required concerning the individual prospector's mining and production methods.

Minor Tire Cuts Repaired Without Loss of Service

A new and improved method of repairing shallow tread cuts has been announced by The Goodyear Tire & Rubber Company. First, the tire cut is probed and all foreign material removed. Then a sharp pointed knife or rasp is used to trim or grind around the cut to form a cone-shaped cavity extending to the bottom of the cut. After the cut has been trimmed out, the tire can be continued in service without danger of impairment of service life or extension of the cut.

Since the real danger to the tire in such cases is from stone, gravel or other material becoming wedged in the cut and grinding farther in, the advantage of the inspection and cleaning out are apparent.

Officials of the Concrete Materials and Construction Company of Cedar Rapids, Ia., have announced that the firm is ready to begin processing limestone rock near Woodland, Mo., to fill a Marion County AAA contract for 40,000 tons of agricultural limestone. Superintendent Guy Dunham stated that it would require three months to fill the contract.

At Salem, Ore., the Independence Sand & Gravel Company's plant has resumed operations after a three-month shut-down for repairs. During this period the bunkers were completely rebuilt.

• At the Crab Orchard Quarry near Crab Orchard, Tenn., this Brooks "Load Lugger" is used to transport the stone to the point of railroad shipment. The stone, which is laid down in laminations of varying thickness, is stripped by hand and loaded into the Lugger by the operator.

Michigan Firm's New Agstone Plant To Feed Lime-Starved Farm Area

another ON THE SPOT report

THE lack of suitable limestone deposits in the state of Michigan has not prevented the Terminal Materials Co., of St. Joseph, Mich., from meeting the heavy demands for agricultural limestone in the vicinity of St. Joe. A. S. Lin-

By FLOYD C. LEVERETTE

denfeld and B. G. Lindenfeld, a father-and-son partnership, were suppliers of building materials, aggregates and coal prior to their successful venture in agstone production 5 years ago. The present plant has given satisfactory performance, but its 60,000 tons per year capacity is insufficient to meet the ever increasing demands for agstone from the "lime starved" farmers of southwestern Michigan. A new year-round plant of 250,000 tons per year capacity is expected by Messrs. Lindenfeld to be in operation by mid-1947.

The present plant is located on the banks of the St. Joe river, a few hundred yards from the point where the river empties into Lake Michigan. This position is a strategic factor in obtaining the necessary limestone. Crushed limestone is purchased from the Inland Lime & Stone Co., Manistique, Mich., and brought to the dock of the Lindenfeld plant in self-unloading ore boats of 5,000 to 9,000 tons capacity. These boats are able to bring in enough stone during the shipping season, lasting until November, to assure an adequate supply of stone until navigation can be resumed in the spring. The dock serves as the stockpile area for the raw limestone.

• A general view of the Terminal Materials Company's plant at St. Joseph, Mich., showing the office building in the foreground and the present plant at the left of the stockpile in the far background. The stockpile is on the dock and is supplied by ships which tie up there.

The pulverizing plant and storage bins are located but a short distance from the stockpile. Either a Ross Carrier loader, capable of handling 5 cubic yards of stone every 3½ minutes, or a General Crane shovel with a ½-cu.-yd. Owens bucket, is used to load a dump truck from the stockpile. The dump truck transports the stone to a hopper which feeds a 30-t.p.h. Godfrey bucket elevator. A chute handles the materials from this elevator to an electrically-driven Williams N. F. 15 hammermill. This portion of the plant is enclosed for protection during cold weather operations.

The pulverized stone, 41 percent of which passes 100 mesh, is elevated to either of two enclosed overhead storage bins, of 100 tons total capacity, by a second Godfrey bucket elevator of 35 tons per hour capacity. A stockpile, adjacent to the bins, receives the overflow of pulverized stone. Delivery trucks or spreader trucks drive under either of the two bins for loading through the bin gates. When loading is done from the stockpile, either the bucket loader or the shovel is used.

Since the finished product is sold exclusively by weight, all departing loads are weighed on the Fairbanks 25-ton scale at the general office building, located several hundred yards from the crushing plant. Al-

(Continued on page 128)

• Left: The two concrete tunnels extending for 140 feet under the stockpile. Each has 14 feeder doors which will feed the conveyor belt bringing material to the plant. The new plant is to be located over the three pits at the mouths of the tunnels.

• Right: An experimental model carrier loader loads raw stone on dump trucks which feed the present plant.

HIGHWAY RESEARCH ACTIVITIES OF THE PUBLIC ROADS ADMINISTRATION

MANY features of the highways of tomorrow have their beginning in the physical research laboratory of the Public Roads Administration. Research experts at the laboratory are constantly engaged in experimental studies of road materials, bridge and pavement design, soil conditions that affect highway engineering problems, and many other phases of highway construction, in an effort to provide better roads and safer driving for American motorists in future years.

Results of tests conducted in the laboratory and field studies of actual road conditions in all parts of the country enable the Public Roads Administration to recommend construction methods that will make the nation's highways more durable and better suited to traffic requirements.

The laboratory, housed in a group of buildings on a 55-acre tract in Arlington County, Virginia, a stone's throw from the National Airport and only a few miles from Washington, D. C., is a source of valuable information for roadbuilders throughout this country and in foreign countries. Many of the studies are carried on jointly with State highway laboratories, the Highway Research Board of the National Research Council or other research agencies. All findings of general interest to highway engineers and road officials are reported in the magazine *Public Roads* and other technical publications.

Photo by courtesy Public Roads Administration

• Locating rock, gravel and other materials needed for road construction is relatively easy when it is done electrically. This apparatus, adapted by the physical research laboratories of the Public Roads Administration to highway problems, indicates with remarkable accuracy the depth and extent of various subsurface strata—sand, clay, rock, gravel, etc., that otherwise could be located only by excavation or borings. Each type of material offers a different degree of resistance to the passage of electric current. The instruments indicate this resistance as current is passed between the two metal stakes.

Highway research has been an important activity of the federal road-building agency since 1893, when the Office of Road Inquiry was established in the Department of Agriculture. The Agricultural Appropriation Act for the fiscal year beginning July 1, 1893, included the modest sum of $10,000 "to enable the Secretary of Agriculture to make inquiries in regard to the systems of road management throughout the United States, to make investigations in regard to the best methods of road-making, to prepare publications . . . and to enable him to assist the agricultural colleges and experiment stations in disseminating information on this subject."

During the early years the bureau's activities were confined largely to the construction of "demonstration" roads and the promotion of campaigns for good roads. After passage of the Federal-aid Road Act of 1916 and the Federal Highway Act of 1921, providing funds on a matching basis to help the states modernize their highways and integrate them into a country-wide network, more attention was given to scientific testing of road materials.

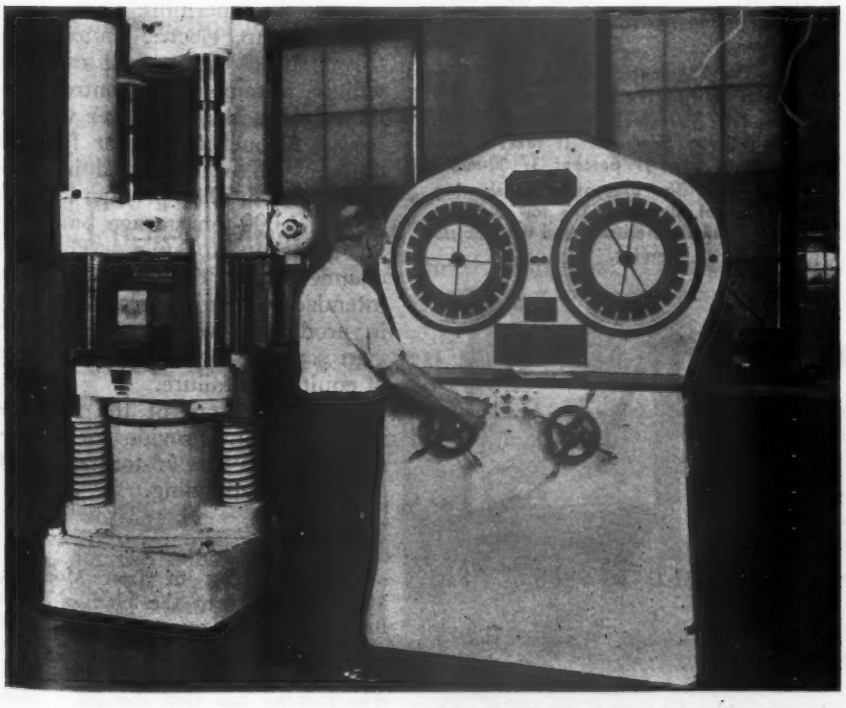


Photo by courtesy Public Roads Administration

• The flexural or "bending" properties of concrete are tested on this machine at the laboratory. Dials at the right register the amount of pressure applied to the concrete beam at the left. This test indicates the weight a sample of road pavement can carry without cracking.

Photo by courtesy P.R.A.

• Left: A research worker is conducting a test to determine the air content of cement mortar. Resistance of concrete pavement to the effects of freezing and thawing depends to a great extent upon the air-entraining properties of the cement. The cement should entrain enough air to furnish this resistance, but not so much that the strength of the concrete is seriously weakened.

• Right: Compressive strength of cement mortar is tested on this apparatus at the laboratory. The dials record the amount of pressure applied to the mortor sample under study. The pressure required to crack the specimen indicates the quality of the cement or sand used in the mortar.

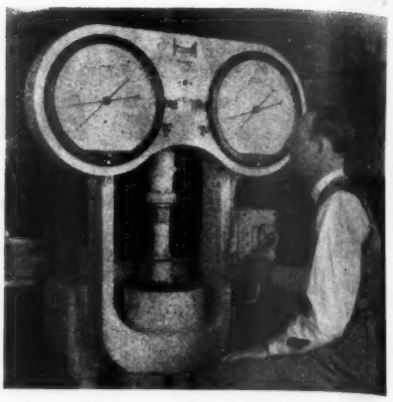


Photo by courtesy P.R.A.

Highway research was recognized as a fundamental basis of sound road construction.

Public Roads' research activities continued to expand during the 'thirties as steadily increasing volumes of traffic created a public demand for wider and stronger highways. Laboratory investigations were restricted during the war years, but work has now been resumed on many of the deferred projects.

The enlarged highway program authorized by the Federal-aid Highway Act of 1944, which is now under way, provides federal assistance for new highway construction in urban and rural areas, in addition to reconstruction of large portions of the Federal-aid system badly battered by heavy wartime traffic. The scope of the postwar highway program, and the need to build roads that will withstand the stress of heavy traffic over a period of years, call for intensive research to develop better methods of road construction. The cost of research is less than 1 percent of the total amount expended by the federal government for highways, but the saving to the nation in future expenditures for road work can be counted in millions.

Michigan Firm

(*From page* 126)

though the company operates 8 dump trucks equipped with spreaders and 9 spreader-type trucks (including 7 Flinks, 1 Baughman and 1 Hi-Way Equipment), hired spreading services are necessary.

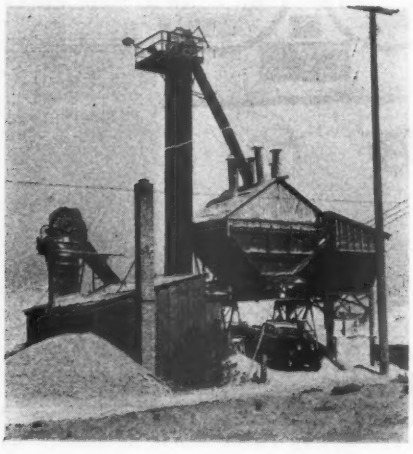
Because of the acute shortage of agstone in this locality, the farmers will spread agstone whenever they can get it, even if spreading has to be done on snow-covered fields. This ready market has prompted the company to design and start construction of a new plant which will more nearly meet consumer demands for agstone. The new plant, construction of which is well under way, will occupy the same site as the present plant. Construction work has been carried on with no production stoppage at the existing plant.

Two 140-ft. concrete tunnels, with overhead gates at 10-ft. intervals, have been built under the present stockpile and at right angles to the river bank. A series of 10-in. ventilation ducts have been installed through which hot air, at 3 pounds pressure, will be forced up through the stockpile to keep the material free of ice during cold weather operations. Material from the bottom of the stockpile will pass through the tunnel gates onto two 140-ft. by 24-in. Link-Belt belt conveyors equipped with a 5-hp. Alliance V5 variable speed drive.

• Left: The Terminal Materials Co. office building, showing the 25-ton truck scale.

• Below, left: The electric pulverizer, which has slugger-type hammers. It takes 2-inch and down to pass 41 percent 3/100-mesh.

• Below, right: The present plant, showing the two bucket elevators. The low building at the left houses the crusher and the electric motor.



These belt conveyors will feed two Pennsylvania model C-3-40, reversible hammermills, each driven by a 125-hp. electric motor. The travel speed of the belt conveyors will be automatically controlled by the load on the pulverizer which it feeds. A bucket elevator for each crusher will be employed in transferring the finished product to either of two 1,000-ton storage bins or to an adjacent stockpile. The dual channel design of the new plant is intended to give the plant flexibility in production volume, and to prevent a complete shutdown in case of equipment failure.

The final steps of the improvement program provide for the installation of a new 75-ton truck scale and a railroad siding.

When residents of Iron Mountain, Mich., objected to the plan of Hoyle Brothers, Inc., to erect a cement storage plant there, the firm selected a new site near the city's rock-crushing plant. Citizens pointed out that the plant would endanger school children.

WILL THE SAME CONVEYOR BELTING HANDLE BARLEY, BRICK AND BRIMSTONE?

YOUR THERMOID DISTRIBUTOR* WILL KNOW

The price you pay for conveyor belting should be based on the service conditions it must meet. To get the belting that's just right for your work, consult your Thermoid distributor. Tell him what is to be moved and he will be able to specify the most economical belting for the job.

He can also tell you—

That Thermoid conveyor and elevator belting is carefully built for the service each is recommended and sold for. He will be able to tell you that impressive records of trouble-free operation have been made by Thermoid beltings largely because each type is designed and made with a thorough understanding of the wear factors in the service specified.

He knows something about Thermoid too—

Thermoid concentrates its manufacturing for industry on the well integrated line as shown below. The Company itself, while large enough to be thoroughly reliable, is still small enough to keep active contact with customers and their problems. That's one of the reasons why—

IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID!

THE THERMOID LINE INCLUDES: INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • TRANSMISSION BELTING • F.H.P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE.

Thermoid Products

AUTOMOTIVE • INDUSTRIAL
OIL FIELD • TEXTILE

THERMOID COMPANY, TRENTON, N. J., U. S. A.

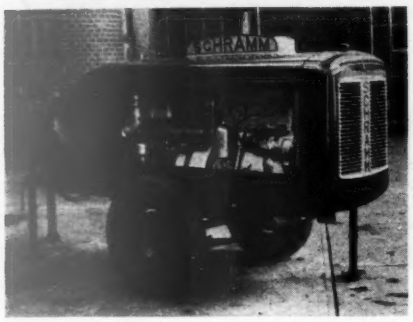
*

A postcard or a letter to the factory will bring his name and address to you.

Manufacturers of new equipment are invited to correspond direct with the home office.

Thermoid
INDUSTRIAL RUBBER PRODUCTS
BUILT FOR THE JOB
QUALITY VALUE SERVICE

New Machinery And Equipment

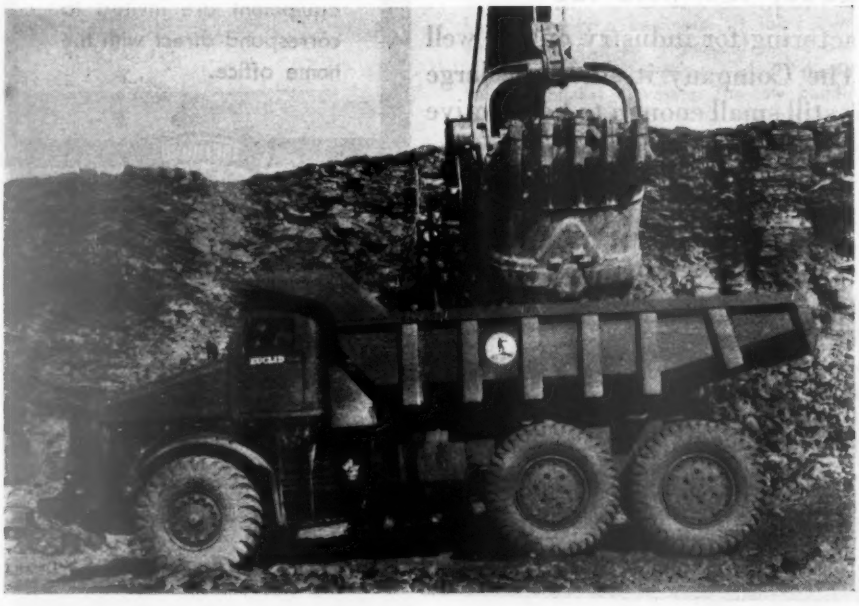


Schramm Inc., West Chester, Pa., are producing the 1947 edition of their Model No. 105 air compressor. This portable unit is equipped with a U-6 International Harvester gasoline engine. The compressor has an air delivery of 105 cubic feet of air.

● Outsize Truck

What is believed to be the largest truck ever built, a 40-ton-capacity unit, was recently completed in the experimental department of the Euclid Road Machinery Company, Cleveland 17, O. It is a rear-dump type, powered by a 12-cylinder supercharged Cummins 550 - hp. diesel engine. Gross weight of the truck with capacity payload is approximately 80 tons.

The truck is shown being loaded with a 6½-cu.-yd. shovel. The tires (Goodyear) are 12.00x24 and 16.00x32.



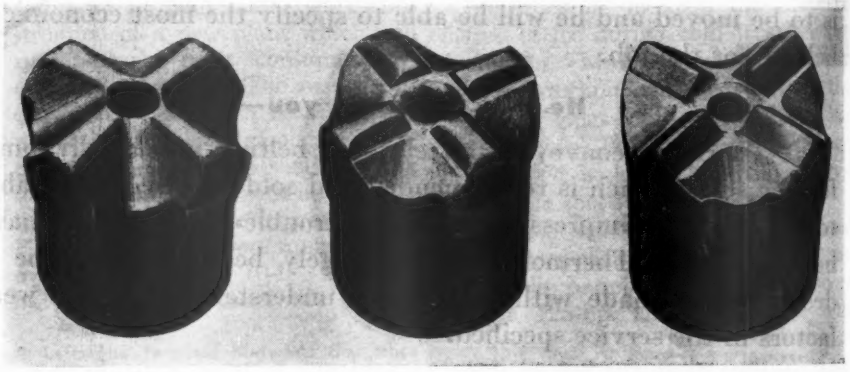
40-ton-capacity truck.

● Jackbit Inserts

An innovation in rock drilling bits has been announced by the Carboloy Co., Inc., Detroit, Mich. The development, consisting of a technique of permanently mounting ultra-hard Carboloy cemented tungsten carbide inserts in four-point jackbits, was produced in cooperation with the Ingersoll-Rand Co. These new jackbits are completely interchangeable with the new line of standard steel stud type Ingersoll-Rand four-point jackbits.

Normal drilling speeds are 12-14 inches with steel drills; but with the new bit speeds as high as 50 inches per minute have been recorded, and speeds of 25-30 inches per minute have been demonstrated.

No apparent reduction in cutting effectiveness or speed is discernible with carbide bits when they have been worn flat. Under conditions of flatness where a steel drill would be immediately replaced, the carbide drill is still good for many feet of high-speed drilling. In general, the new bits will produce between 50 and 200 times the depth of hole obtainable with steel bits before reconditioning. Tests in drilling Indiana limestone were discontinued at 650 feet with no appreciable dullness or reduction in drilling speed, and a loss of only .006 inches in gauge. It is claimed that this low loss in gauge, together with faster permissible drilling speeds, will greatly reduce air consumption, since less actual rock is drilled when "tapered holes" are not necessary.



Left to right: Steel bit after drilling 2 feet, bit with new blade after drilling 249 feet, new bit before drilling.

A new wheel puller set marketed by Raybestos-Manhattan, Inc., Bridgeport, Conn. Five pullers capable of servicing any standard wheel manufactured in the last fifteen years comprise the set, designated the Raybestos 501 Universal.

Mystic Maze

(Isotherm Adsorption Apparatus)

Seen through this mystic maze of tubes and wiring is a Sinclair Research technician. What his apparatus means to users of industrial lubricants is no mystery, however.

At Sinclair Laboratories, the Isotherm Adsorption Apparatus is used constantly to determine the effectiveness of adsorbents used in lubricating oil refining procedures. Because Sinclair lubricants are made with infinite care to suit the specific requirements of your equipment, it is highly important to know exactly how adsorbents, catalysts, and other treating materials perform in a refining process.

This intricate apparatus is an assurance that Sinclair lubricant manufacture guarantees the very highest quality product. It is one more evidence of the painstaking Sinclair research and refinery control that result in outstanding lubricant performance.

Sinclair Automotive Oils

For Bus, Truck and Tractor

OPALINE

TRUCK BUS TRACTOR

MOTOR OIL

Superior lubrication in the long pull, under heavy loads

• • •

Keeps engines clean . . .
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SINCLAIR

Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE

● Mineral Separator

The Humphreys Spiral Concentrator is now available in two models for the separation and concentration of ores and minerals. Made by The Humphreys Investment Co., First National Bank Building, Denver 2, Colo., this equipment has been in use for some time in several large plants, among them a plant near Jacksonville, Fla., which treats 7500 tons per day of sand in 252 rougher spirals and additional spirals for cleaning, as a preliminary step in production of ilmenite for manufacture of white pigment for paint, rutile used principally for coating welding rods, and zircon used for vitreous enamel finishes and refractory furnace linings.

The Humphreys Spiral consists of a spiral conduit of modified semi-circular cross-section. Ore pulp is fed to the top, and, as it flows downward, the heavier particles concentrate in a band along the inner side of the pulp stream. Outlets for the removal of products are located at the lowest points in the cross-section of the conduit. Wash water, added at the inner edge of the stream, flows outwardly across the concentrate band. The width of this band removed at the outlets is controlled by adjustable splitters. Concentrate is usually removed from the upper portion of the spiral, and middling from the lower portion, since it generally takes only one turn of the spiral to produce a 90 percent recovery of heavy minerals. Tailing is discharged from the lower end of the spiral.

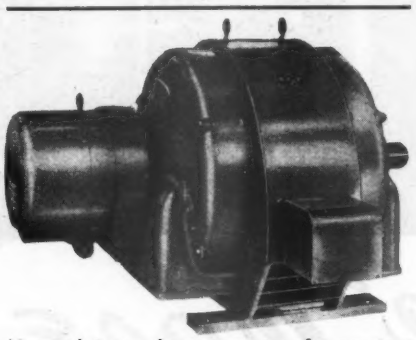
Capacity per spiral varies from approximately ¾ to 1½ short tons per hour of new feed, depending on the character of the material, with about 1¼ ton per hour an average feed. In general, better concentration is achieved on pulps containing heavy mineral particles ranging in size between 14 and 200 mesh, and when the spiral is well loaded and the rate of feed fairly constant.

The water requirement is about 20 to 25 gallons per minute per spiral, including from 2 to 5 gallons per minute of wash water. Some water can be reclaimed and fed back into the circuit.

Since there are no moving parts, cost of operation is said to be extremely low, consisting principally of cost of delivering pulp to the spiral and disposing of product and tailing. Space required is also small, about 700 sq. ft. per 1000 tons of daily capacity of single stage or rougher spirals.

Spirals can be used in roughing kyanite ore, mica ore and for removal of silt, zircon, magnetite, clay, etc. from sand and other products.

Concentrating action of spiral.



Heavy-duty synchronous motors for constant speed drives up to 1,000 hp. are available in splash-proof construction, as announced by the Electric Machinery Mfg. Company, Minneapolis 13, Minn. Sealed bearings can be cleaned and refilled in this model without motor disassembly.

● Roof Coating

The Richkraft Company, Chicago, has announced the availability of Richlume —a new roof coating, said to have unusual insulating, waterproofing, and fire-resistive qualities when applied with brush or spray to tar-and-gravel, built-up asphalt, or composition shingle roofs.

A new plastic vehicle for the aluminum pigment in Richlume reportedly produces a close bond with roofing materials without penetrating below the surface. In addition, it is claimed that the vehicle remains flexible and allows the Richlume coating to expand and contract with the roofing under any weather conditions, thus tending to prevent cracking, bleeding or checking of the surface.

● Electric Hoists

The Yale & Towne Manufacturing Company, 4530 Tacony Street, Philadelphia 24, Pa., now includes a 2-ton model in its line of electric hoists. The new "Midget King" is equipped with a 1-hp. motor and lightweight alloy steel roller chain. Lifting and lowering action is obtained by a one-hand bar-grip control. The unit is available with a hook for stationary use or a permanently attached trolley for use on an overhead track.

2-ton hoist.

The load hook is of special steel and was designed to open slowly without fracture before any other part of the hoist is strained to the yield point. Upper and lower limit safety stops are provided to prevent overtravel of the hook. The load brake and the independently-acting motor brake operate whether the power is on or off; both brakes, all wiring and the controller are totally enclosed. Accessories include a chain container for slack chain.

● Centrifugal Pumps

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced a new line of "Pedrifugal" pumps, developed at its Norwood Works.

This new line of cast iron bronze-fitted, pedestal-type centrifugal pumps comes in three principal sizes—from 1 to 3 inches. Capacities are from 10 to 500 g.p.m. at heads from 10 to 100 feet, with power requirements from ¼ to 15 horsepower.

Pedrifugal pumps are expresssly designed for use with Texrope V-belt drives, giving a large range of capacities regulated by size of sheaves and power supplied. All pumps are fitted with impellers of maximum diameter, and variations in capacity are provided by changes in speed through sheaves of larger or smaller diameter.

Construction features embody the following: Only one fit—that between the pedestal and the casing; an open impeller keyed to the shaft and fitted with an impeller lock nut, which will handle liquids containing a considerable volume of solid material; a precision-made, mechanical seal; two bearings of ample size for either direct or belt drive.

STRIP-EASE!

THERE'S A HERCULES DISTRIBUTOR NEAR YOU

ALABAMA—BIRMINGHAM: Aronov Auto Supply Co., Inc., 420 S. 21st St. MOBILE: Batbeze, 610 St. Anthony. MONTGOMERY: Jake Aronov Auto Parts & Tire Co., Cor Bell & Whitman Sts.

ARKANSAS—LITTLE ROCK: G. L. Turner, Inc., 320 E. Markham St. MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W

CALIFORNIA—LOS ANGELES: General Truck Equipment Co., 1081 N. Vignes. OAKLAND: A. Pasteris Co., 2200 Wood St.

COLORADO—DENVER: The Colorado Builders' Supply Co., 324 S. Broadway.

FLORIDA—JACKSONVILLE: Clark Equipment Inc., 1839 Main St.

GEORGIA—ATLANTA (COLLEGE PARK) Carley Trailer & Equipment Co.

IDAHO—TWIN FALLS. Twin Falls Equipment Co., 251 Main Ave., W.

ILLINOIS—CHICAGO: Voltz Bros., Inc., 2320 Indiana Ave. PEORIA: A. W. Moore, 2710 S. Adams St BETTENDORF, IOWA: Standard Wholesale Co., 1525 State St. ST. LOUIS, MO.: Truck Equipment Co., 511 N. Channing Ave. EVANSVILLE, IND.: Hercules Body Co., Inc.

INDIANA—EVANSVILLE: Hercules Body Co., Inc., FORT WAYNE: Pearless Manufacturing Co., 4227 Bluffton Rd. INDIANAPOLIS: John Guedelhoefer Wagon Co., Inc., Kentucky Ave., at Georgia Ave. LOUISVILLE, KY.: J. Edinger & Son, 1010 Story Ave. CINCINNATI, O.: The Bode-Finn Co., 2650 Spring Grove Ave.

IOWA—BETTENDORF: Standard Wholesale Co., 1525 State St. CEDAR RAPIDS: E. Cohn & Sons, Inc. SIOUX CITY: Barton-Stephens & Co., 1909 E. Fourth St.

KENTUCKY—LOUISVILLE: J. Edinger & Son, 1010 Story Ave. HUNTINGTON, W. VA.: Huntington Truck Equipment Co., 919 Sixth Ave. EVANSVILLE, IND.: Hercules Body Company, Inc. CINCINNATI, O.: The Bode-Finn Co., 2650 Spring Grove Ave.

LOUISIANA—NEW ORLEANS: Magnolia Equipment & Security Corp., 900 Jefferson Hwy. SHREVEPORT: Dealers Truck Equipment Co., Inc., 1561 Texas Ave. MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W.

MARYLAND—BALTIMORE: United Truck Equipment Co., 1242 S. Paca St.

MASSACHUSETTS—CAMBRIDGE: Hercules-Campbell Body Co., 130 Brookline St.

MICHIGAN—DETROIT: Waggy-Hoffman Equipment Co., 14089 Schaefer Hwy. CHICAGO, ILL.: Stahmer Supply Co., 135 S. LaSalle St.

MINNESOTA—ST. PAUL: General Truck & Equipment Co., 2535 University Ave.

MISSISSIPPI—MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W. MOBILE, ALA.: Batbeze, 610 St. Anthony.

MISSOURI—KANSAS CITY: American Body & Equipment Co., 1411 Charlotte St. ST. LOUIS: Truck Equipment Co., 511 N. Channing Ave.

MONTANA—BILLINGS: Western Construction Equip. Co., 305 N. 24th St. MISSOULA: Western Construction Equip. Co., 218 W. Pine St.

NEBRASKA—LINCOLN: Highway Equip. & Supply Co., 21st & N Sts. SCOTTSBLUFF: Colorado Builders Supply Co., 602 W. 27th St.

NEW MEXICO—ALBUQUERQUE: The Harry Cornelius Co., 1510 N. Second St.

NEW YORK—BUFFALO: Truckstell-Wilcox, Inc., 224 W. Utica St. TARRYTOWN: Hercules-Campbell Body Co., Inc. WATERLOO: Hercules-Campbell Body Co

NORTH CAROLINA—RALEIGH: J. B. Hunt & Sons, 323-25 W. Martin St. SPRUCE PINE: Mitchell Distributing Co.

NORTH DAKOTA—ST. PAUL, MINN.: General Truck & Equip. Co., 2535 University Ave.

OHIO—CANTON: Ewing Brothers, 929-41 Cleveland Ave., N. W. CINCINNATI: The Bode-Finn Company, 2650 Spring Grove Ave. CLEVELAND: The Trailmobile Company, 1808 E. 22nd St. COLUMBUS: Hercules Body Sales Co., 580 Hamlet St. UHRICHSVILLE: Wells Body Co., 112-20 Lake St. YOUNGSTOWN: O'Dee Truck Body Sales, 2035 Ohio Ave. HUNTINGTON, W. VA.: Huntington Truck Equip. Co., 919 Sixth Ave. DETROIT, MICH.: Waggy-Hoffman Equipment Co., 14089 Schaefer Highway.

OKLAHOMA—LAWTON: Tompkins Auto Salvage Co., 917 S. Second St. OKLAHOMA CITY: The Diesel Power Co., 1801 N. E. Ninth St. TULSA: The Diesel Power Co., 4th & Elgin Sts.

OREGON—PORTLAND: Newell Truck Equipment Co., 316 N. Russell St.

PENNSYLVANIA—ALTOONA: Brumbaugh Body Co., 100 Plank Road. ERIE: The Trailmobile Co., 1223 Walnut St. LEBANON: M. A. Brightbill Body Works, E. Cumberland St. at 7th Ave. PHILADELPHIA: Eastern Body Co., 31st & Fletcher Sts. PITTSBURGH: Hercules-Pittsburgh Body Co., 1717 Mary St., S. S

SOUTH CAROLINA—COLUMBIA: South Carolina Equipment Co., P. O. Box 295.

SOUTH DAKOTA—ST. PAUL, MINN.: General Truck & Equip. Co., 2535 University Ave.

TENNESSEE—CHATTANOOGA: Tod Nelson Service & CHR Alignment Co., 416-18 Market St. KNOXVILLE: Knoxville Structural Steel Co., P. O. Box 1512. MEMPHIS: Dealers Truckstell Sales, Inc., 365 S. Parkway, Halliburton & Lane Co., 5th Ave. at McGeveck.

TEXAS—DALLAS: Truck Equipment Co., 2409-11 Commerce. FORT WORTH: Truck Equip. Co. HOUSTON: McArthur Welding & Press Co., 5525 Clinton Dr. SAN ANTONIO: Patton Machinery Co., 1318 N. Alamo St. CORPUS CHRISTI: Truck Equip. Co., 1501 Port Ave.

UTAH—SALT LAKE CITY: Hercules Body Sales Co.

VIRGINIA—NORFOLK: A. S. Drumwright & Co., 1921 Brambleton Ave. RICHMOND: Crenshaw Equipment Co., Inc., 304 E. Main St.

WASHINGTON—SEATTLE: Allied Trailer & Equip. Co., 1331 Third Ave.

WEST VIRGINIA—BLUEFIELD: Truck Equip. Engineering Co., P. O. Box 387. CHARLESTON: West Virginia Tractor & Equip. Co., P. O. Box 473. CLARKSBURG: West Virginia Tractor & Equip. Co., 100 Wood St. HUNTINGTON: Huntington Truck Equip. Co., 919 Sixth Ave.

Only well-built equipment stands up under the weight and impact of a load dropped by a dragline. This Hercules is one of a fleet operating in a Pennsylvania strip mine.

You'll go a long way to find a hauling and dumping job as tough as that in the average strip mine operation . . . and you'll go just as far to find equipment as well fitted for this rugged service as Hercules Dump Bodies and Hydraulic Hoists. *There*'s a combination that's built for business. If you've got a hauling and dumping job that's too much for ordinary equipment, you'll want to know all about Hercules heavy-duty bodies and hoists.

Hercules equipment is designed for the job. This 6-yard capacity unit has special cab protector and is equipped with a Hercules 8X Hydraulic Hoist.

Check the list opposite for name of Hercules distributor nearest you.

HERCULES

Dump Bodies *and* Hydraulic Hoists

HERCULES STEEL PRODUCTS CORP. • GALION, OHIO

● Self-adjusting Goggles

The M.S.A. "Speedframe," a self-adjusting welder's goggle which is made by the Mine Safety Appliances Company, Braddock, Thomas and Meade Streets,

Welder's glasses.

Pittsburgh, is raised or lowered by a nod of the head, leaving both hands free. The goggles are mounted in a lightweight fiber headframe so designed that they are held securely in either position.

Speedframe can be furnished with welder's or chipper's goggles.

● Material Spreader

The "Even-Spread" spreader is designed especially for spreading high quality fine dry materials and has no belt or chain and slat conveyors or spinning discs or paddles to separate the different sized particles and throw the finer particles to the wind. It has a positive even feed from the bed to a postive even-spreading mechanism which is designed to insure accuracy and uniformity for different rates of application.

The Even-Spread spreader has a welded all-steel body with two special open-spiral conveyors of equal size and speed in troughs in the bottom. These conveyors are driven by the power take-off on the truck transmission which by changing the speed of the conveyors regulates the flow of material to the cross distributor in proportion to the distance covered by the truck.

The spreading mechanism, mounted directly under the ends of the spiral conveyors, has two detachable tubes, each containing a spiral conveyor which is direct driven by a central permanently mounted unit; this in turn is driven from the end of one of the conveyors in the bed. The tubes have slots which can be adjusted to give an even spread over the entire length of the tube when spreading materials of different physical properties or at different rates of application.

The rate of application is very little affected by the amount of the material in the bed, which remains almost constant throughout the unloading period. An attachment can be furnished to mix and spread lime and fertilizer at the same time in accurate amounts.

Spreads lime evenly.

An electric arc-welded, coke-burning cupola for use in melting rock or slag for the manufacture of mineral wool has been placed on the market by Superior Metal Products, Inc., 1819 South Brandon, Marion, Ind. The 54-inch diameter cupola is shipped with bustle pipes and tuyeres knocked down, allowing shipment of the complete unit in a railroad car or by trailer-truck.

● Rubber Hose Repair Kit

A new master kit of "Punch-Lok" bands designed to serve all needs for clamping or banding rubber hose to nipples and fittings and for a wide variety of general repair applications is now being merchandised by The B. F. Goodrich Company, Akron, O.

Tool kit.

Each kit contains a quantity of both open-end and preformed Punch-Lok bands which can be applied in the non-metallic minerals industries and on the farm for various types of repairs.

● Hydraulic Conversion Units

Owners of tractors equipped with hydraulic dozers will be interested in the new hydraulic conversion units recently developed by LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Ia. Designed for hooking into existing hydraulic systems, these new units make it possible to operate 2- or 4-cu-yd. scrapers in combination with present dozers without having to purchase an additional hydraulic system for scraper operation.

The conversion "packages" are available in two designs, one for adapting the 2-yd. LaPlant-Choate scraper to present D-2 hydraulic dozers and the second for adapting the 4-yd. scraper model to D-4 dozer units. The conversion assembly for

Dual valve required for conversion.

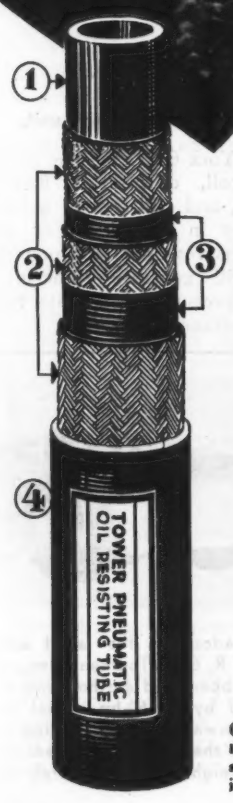
D-4 tractors equipped with hydraulic dozers consists of two valves which mount on the rear of the tractor with manifold and necessary hose for connections to the hydraulic circuit. The unit for the D-2 tractor-dozer has special combination piping fitted into the hydraulic system and is operated by the same valve which operates the dozer.

• Order TOWER, other Republic Hose and Belting from your Republic Distributor.

No injury to this "RUBBER LUNG" when they blow through stone

EACH BLOW dealt by air tools at work in mines or quarries represents the repeated internal stresses and pulsations that are being handled by the rubber lungs between tools and compressors. These hose lengths also take constant beating from dragging, crushing, hot oil in the line, exposure, etc. Failures in ordinary hose, under the severe abuse, have resulted in a steadily increasing preference for Republic's Tower Pneumatic Hose. Thanks to advanced achievements in hose construction, Tower can take the hard knocks and usage without injury or impairment of its maximum, built-in service life. Tower's high mechanical strength and resilience are belied by its added efficiency of light weight.

MORE SERVICE FROM RUBBER FOR INDUSTRY



(1) Seamless, oil and heat-resistant, extruded rubber tube. (2) High tensile, twisted cords braided into seamless, tubular plies. (3) Rubber insulating layers assuring firm ply adhesion. (4) Special abrasion, cut, weather and sun-resisting rubber cover, extruded without seam.

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LEE RUBBER & TIRE CORPORATION

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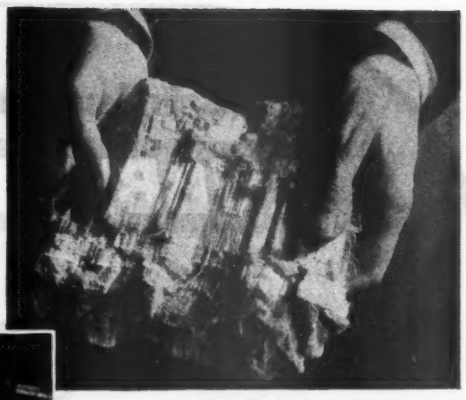
REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN O

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA

Made..

by the world's largest producers of ASBESTOS, J-M Friction Materials are mechanically strong, highly heat-resistant!



..Tested

in the famous J-M Research Laboratories under actual field conditions!

Available..

through Johns-Manville Distributors everywhere!

The highly trained buyers of most leading manufacturers started your industrial equipment off *right* with J-M Friction Materials . . . controlled from mine to user by the outstanding producer of asbestos products. *Stay* with Johns-Manville and you're sure of the best! Contact your nearest J-M Distributor for help in selecting the proper style of J-M Friction Material . . . or write to Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville

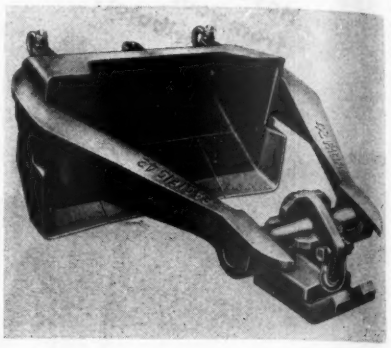
INDUSTRIAL FRICTION MATERIALS

No. 1 With Leading Manufacturers

● Drag Scrapers

The development of a new line of drag scrapers for haulage and transfer operations in rock plants and quarries has been announced by Alloy Steel and Metals Company, 1862 E. 55th St., Los Angeles, Calif.

In place of the horizontal blades, Pa-

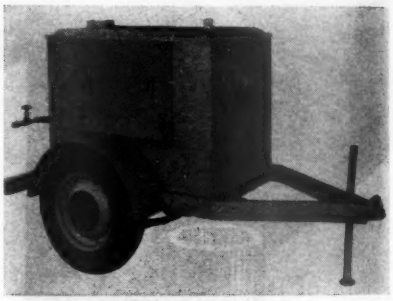


For hauling rock.

cific drag scrapers are provided with newly-designed, self-sharpening corner cutters, designed to assure effective digging action. The shoe, which attaches to the front of the harness, is made of a tough manganese steel.

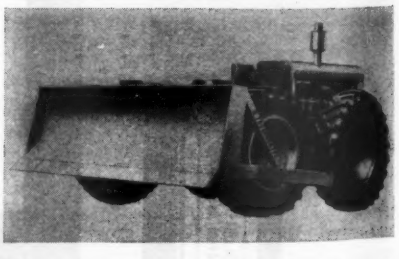
● Steam Cleaner

A new steam-vapor cleaning unit is now available for delivery, announced by Oakite Products, Inc., 157 Thames



Steam generating unit.

St., New York 6, N. Y. The device is an enclosed-coil, down-draft flame steam generator, and will deliver a hot vaporized spray in either wet or dry state under pressures up to 200 pounds. This model will generate sufficient steam-cleaning pressure to operate two steam guns simultaneously.



The Tournadozer is the latest addition to the line of R. G. LeTourneau, Inc., of Peoria, Ill. This rubber-tired earthmoving equipment is powered by a 160-hp. diesel engine. It has four forward speeds ranging up to 12 m.p.h., and the same four speeds in reverse. Shipping weight is approximately 14½ tons.

PERSONAL MENTION

WILLIAM P. HEMPHILL, who has been for the last five years president of the Laclede-Christy Clay Products Company of St. Louis, Mo., has resumed active participation in the management of the Chicago engineering firm of McKinsey, Kearney & Company, of which he is a partner. Mr. Hemphill will continue as a consultant and director of Laclede-Christy.

M. E. Snyder

MARK SNYDER, director of Industrial relations for the Marblehead Lime Company of Chicago, was recently given a signal honor at a meeting of the National Association of Personnel Directors in Chicago. Upon that occasion Philip H. Ragan, president of the association, presented Mr. Snyder with a key for his outstanding contributions in the field of better management-labor relations.

Mr. Snyder, who is a charter member of the personnel men's group, is nationally known as a labor consultant.

H. J. TILLIA is now superintendent of the Westvaco Chlorine Products Corporation, in charge of operations at the magnesite property at Gabbs, Nev. Mr. Tillia will supervise all barite properties of the firm in California and Nevada, as well as the exploration of nonmetallic materials in the Western states.

WILTON T. MILLAR, who was formerly a U. S. Bureau of Mines mining engineer, has resigned from his position to become general superintendent of mining and milling operations for the Kyanite Mining Corporation at Cullen, Va.

A. C. HARDING, who has been associated with the Baroid Sales Division of the National Lead Company for the last nine years, has resigned as general superintendent to organize his own company. With his associates he will build and operate a bentonite plant at Moorcroft, Wyo. During World War II Mr. Harding was superintendent of National's Clay Spur, Wyo., bentonite plant.

F. I. BRISTOL, president of the Bristol Silica Company at Rogue River, Ore., has been named president of the Oregon Mining Association. Mr. Bristol succeeds Samuel H. Williston, who is vice-president of the Horseheaven Mines and the Cordero Mining Company.

THERON C. TAYLER of the Tayler Engineering Service, Detroit, Mich., is the newly-elected treasurer of the Detroit chapter of the Michigan Society of Professional Engineers.

L. D. RICHARDS, chief engineer of the Dow Chemical Company, Midland, Mich., has been elected a director of the Saginaw chapter of the Michigan Society of Professional Engineers.

ARTHUR HEWITT of the Warner Company, Philadelphia, has been elected president of the Central Pennsylvania chapter of the Pennsylvania Society of Professional Engineers.

JULIUS C. REED, 44, who had been associated with the Medusa Portland Cement Company for 17 years, died unexpectedly on April 6 at his home in Madison, N. J.

H. H. MOORE, secretary-treasurer of the Superior Cement Corporation of Portsmouth, O., is now vice-president of all the firm's operations except sales.

Other new Superior appointments announced were those of J. K. LONG, treasurer, and G. W. QUILLIN, secretary.

HENRY D. OSTERHOLZ has recently become associated with the Anderson Brick & Supply Co., Inc., New York City, as general sales manager. Mr. Osterholz was for ten years New York City sales manager for the Lehigh Portland Cement Company.

F. E. Lobaugh

FRANK E. LOBAUGH has been appointed technical service director of the Lumnite Division, Universal Atlas Cement Company, a United States Steel Corporation subsidiary.

Mr. Lobaugh is a member of the American Ceramic Society, the Institute of Ceramic Engineers, the New Jersey and New York Ceramic associations, and the American Society for Testing Materials.

Appointment of WALTER T. JOHNSON as New York district sales manager for the Columbia Chemical Division of Pittsburgh Plate Glass Company was announced today by W. I. Galliher, executive sales manager for the division.

Mr. Johnson joined the firm's research department at the Barberton, O., plant during 1930 and has been associated with the chemical division since then. Following several years' service in plant production and technical service departments, he was manager of the Chicago district sales office for three years.

J. J. HORNUNG, assistant treasurer of Lehigh Portland Cement Company of Chicago has retired after 37 years of service. L. A. STACK has succeeded Mr. Hornung.

R. S. Adkins

ROY S. ADKINS has been elected vice-president and general sales manager of the North American Cement Corporation of New York, according to an announcement made by THOMAS J. HARTE, president.

Mr. Adkins became affiliated with the firm in 1928 as a salesman in the Baltimore district. In 1932 he became district sales manager in Washington, D. C., and in 1937 was promoted to the post of general sales manager in New York.

Louis Ware

COLONEL LOUIS WARE of Chicago has been elected a director of United States Gypsum Company of Chicago.

Colonel Ware is also a director of The International Minerals and Chemical Corporation, which is now completing two new plants — at Noralyn, Fla., and San Jose, Calif.—each costing over $5,000,000.

HARRY E. BLAKELY was recently named managing director, Highway Contractors' Division, American Road Builders' Association. He replaces BURTON F. MILLER, who is now executive secretary of the Michigan Road Builders' Association.

HOWARD F. KICHLINE has been made operations manager of the North American Cement Corporation's plants at Catskill and Howe's Cave, N. Y., Security, Md., and Berkeley, W. Va. Mr. Kichline has been chief chemist and assistant operating manager at Catskill. He has been associated with the firm for the last 32 years.

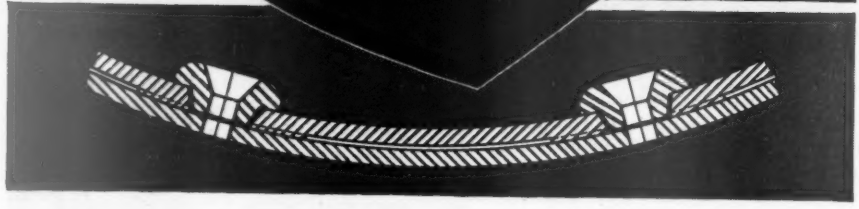
F. L. HERBERT, who has been foreman at the Medusa Portland Cement Company's Wampum (Pa.) plant for several years, retired from his duties recently. He has been with the firm since 1910, when it was known as the Crescent Cement Company.

FRANK POTTS has been made export sales manager of the Permanente Cement Company. He was formerly a member of the export sales departments of several other Kaiser companies, having joined the organization in 1943. He will report to Permanente's general sales manager, James K. Beatty in Oakland, Calif.

KENNETH KINNISON has been appointed to succeed FRANK SNYDER, resigned, as superintendent of the L. W. Hayes quarries, Bethany, Mo. Mr. Snyder is now the owner of the Daviess County quarry, located near Jamesson, Mo.

LORAIN ROLLED PLATE LININGS

Last Longer



because —

. . . they offer exceptionally high resistance to abrasion.
. . . plates and lift bars are reversible.
. . . lift bars are renewable at partial lining costs.

THE net result means reduced maintenance costs, fewer replacements, more grinding time.

But longer service life is just one of the reasons why it will pay you to use U·S·S LORAIN ROLLED PLATE LINING in your grinding mills. For example, their high strength and toughness often make possible the use of thinner plates, thus increasing mill diameter and resulting in greater output.

They go in faster, too!

Their simplicity of design and ease of handling speeds up installation. In some large mills as much as 12 mandays have been saved.

This superior plate lining is available in the diameter, length and thickness best suited to your operating conditions. It will produce better results more economically no matter what you grind. U·S·S LORAIN ROLLED PLATE LININGS are available through leading grinding mill manufacturers whose names will be furnished on request.

U·S·S LORAIN GRINDING BALLS give uniformly superior results

Forged from new steel and accurately heat-treated to take the punishment of abrasion and impact throughout long, heavy runs, these grinding balls maintain a standard of quality that insures uniformly superior results. Available in all standard sizes from ¾" to 5" in diameter.

USS STEEL — UNITED STATES STEEL

U·S·S LORAIN ROLLED PLATE LINING

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Export Company, New York

7-385

UNITED STATES STEEL

A. W. RAAB and J. T. GORDON have received new appointments on the Lone Star Cement Corporation's staff. Mr. Raab has been named general purchasing agent, succeeding H. E. KERBY, retired.

Mr. Gordon was appointed assistant general purchasing agent.

A visitor to PIT AND QUARRY headquarters a few weeks ago was JOHN REITLE of the Slemmestadt Portland Cement Company, Oslo, Norway. Mr. Reitle, who is chief chemist for the Norwegian firm, visited several American cement plants during his stay in this country.

OBITUARIES

JAMES ROBERT DAVIDSON SR., 79, a former partner in the Cincinnati Quarries, died on March 27 in Deaconess Hospital, Cincinnati. He was active in the business until his retirement in 1942.

ELMER ROBERTSON, an employee for the past ten years of the Missouri Sand and Gravel Company, died in his home at Barry, Ill., on March 8.

NORMAN M. DREW of the Drew & Son sand and gravel business in Skaneateles, N. Y., died recently in Auburn City Hospital.

ROYALL D. BRADBURY, principal highway engineer of the Public Roads Administration and internationally known authority on reinforced concrete, died suddenly of a heart attack at his Washington, D. C., home on March 21. He was 63 years old.

Mr. Bradbury joined the Public Roads Administration in 1946. He served for several years as chairman of the Committee on Rigid Pavement Design of the Highway Research Board. He was a member of the American Society for Civil Engineers, the American Concrete Institute and the American Society for Testing Materials.

HENRY WILLIAM CROFT, 81, retired chairman of the board of Harbison-Walker Refractories Company, of Pittsburgh, died at his home on February 23.

Mr. Croft was also formerly a director of the Mellon National Bank of Pittsburgh, Koppers Coke Co., Mack Trucks, Inc., Republic Iron and Steel Co., General Railways Signal Co., and Certain-teed Products Corp.

CLARENCE C. CHAMBERLAIN, captain of the tug *Pennsbury*, owned by the Warner Company of Philadelphia, died on February 9. He had piloted the company's vessels on the upper Delaware River for many years.

ARTHUR C. COBB, vice-president and general manager of the Georgia Lime Rock Company of Ocala, Fla., died at his home in Perry, Ga., on February 22.

TRADE NOTES

J. F. Berger

J. F. Berger has been appointed to the position of assistant sales manager of the Woven Wire Fabrics Division, John A. Roebling's Sons Company.

Mr. Berger has been with the company for 37 years serving as a salesman and field engineer for the Woven Wire Fabrics Division.

Under a newly adopted regional setup for the field organization of the Allis-Chalmers general machinery division, Allis-Chalmers branch offices in the new regions become district offices. According to J. L. Singleton, manager of district offices, the following are now designated as district managers in the first four regions established:

In the New England region, A. B. Frost and R. H. Porterfield are managers of the New Haven and Providence district offices, respectively reporting directly to W. F. Taylor, Boston, manager of the region.

In the Southwest region, W. R. Horrigan, Aubrey Phillips, E. R. Hury, L. G. Park and R. I. Moore are managers of the Amarillo, Houston, San Antonio, Shreveport and Tulsa district offices, respectively, reporting directly to J. L. Pratt, region manager, who has ben succeeded as manager of the Dallas district office by H. L. Raynolds.

In the Southeast region, J. J. Greagan, William Parker, J. W. Roberts, G. H. Hoffman, A. R. Knauss, Joseph Bronaugh, R. F. Muller and A. D. Robertson are managers of the Birmingham, Charlotte, Chattanooga, Knoxville, Memphis, Miami, New Orleans and Tampa district offices, reporting directly to D. S. Kerr, manager of the region, who is succeeded as manager of the Atlanta district office by Charles F. O'Riordan.

In the Pacific region, F. V. Sams, F. Harvey Searight, U. E. Sandelin remain as managers of the Portland, San Francisco and Seattle district offices, respectively, reporting directly to A. J. Schmitz, manager of the region. In the same region, C. W. Schweers, formerly manager of the firm's Houston district office, becomes manager of the Los Angeles district office, succeeding A. D. Brown, named manager of the company's Washington, D. C., office. R. N. Landreth, who has been acting manager of the Washington office, will now devote full time to his special duties as assistant to Vice-President Johnson.

No Rocking-No Bobbing

. . . with a SECO vibrating screen

Smooth! That's the word to describe the true circular motion of a Seco vibrating screen. Yes, sir, and that's the big reason why operators everywhere screen more tons per hour with Seco vibrating screens. There's no wasted motion . . . no weaving from side to side . . . no stormy sessions with supporting structures, thanks to Seco's patented equalizer assembly. Put a Seco to the test! And you'll be a happy "skipper" with better production at lower cost. Write today for "A Guide to Better Screening." Dept. A.

TRUE CIRCULAR MOTION VIBRATING SCREENS

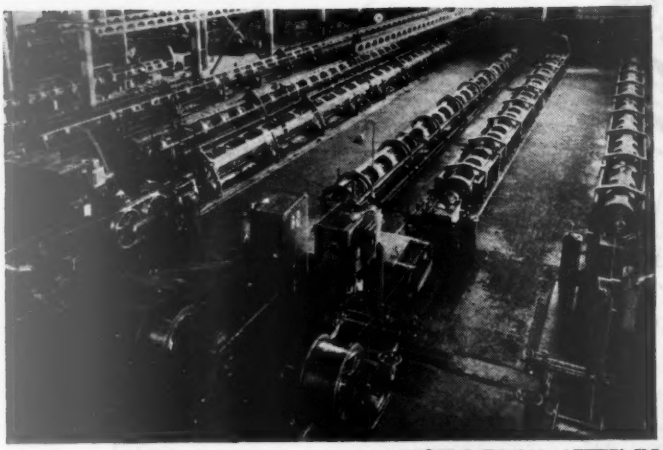
SECO

SCREEN EQUIPMENT COMPANY, INC.

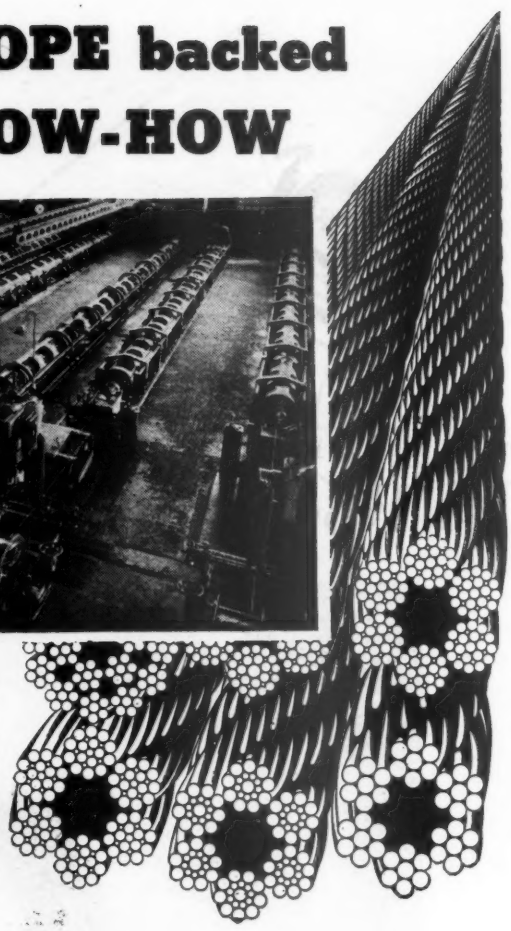
9 Lafayette Avenue, Buffalo 13, New York

In Canada: United Steel Corp., Ltd., Toronto

Buy the ROPE backed by the KNOW-HOW



Here are a few of the stranding machines in Wickwire Spencer's modern wire rope mill. In principle, these machines are not unlike those found in many rope mills. The difference—the thing that makes Wickwire Rope longer lasting—lies in the making of the steel and drawing of the wire used in the rope.



Only steel wire with the highest possible degree of perfection in hardness, strength, toughness and fatigue-resistance is used. And every wire used in making Wickwire Rope is drawn until it's accurate within a fraction of a thousandth of an inch.

Distributors and Wickwire Rope engineers in all parts of the country are prepared to render prompt service in solving your wire rope problems and meeting your wire rope needs. Wickwire Rope is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed.

VALUABLE GUIDE FOR ALL ROPE USERS—Thousands of wire rope users have found that the information packed in the 82 pages of "Know Your Ropes" has made their work easier. It's full of suggestions on proper selection, application and usage of wire rope. This easy-to-read, profusely illustrated manual is free. For your copy write, Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Mass.

CF&I & SUBSIDIARIES

WICKWIRE ROPE

A PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
OF THE COLORADO FUEL AND IRON CORPORATION

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass.
GENERAL OFFICE—500 Fifth Avenue, New York 18, New York
SALES OFFICES—Abilene (Tex.) • Boston • Chattanooga • Chicago • Denver • Detroit Philadelphia • Tulsa • Fort Worth • Houston • Newport News • New York
PACIFIC COAST—The California Wire Cloth Corporation, Oakland 6, California

F. A. Mertz

Frederick A. Mertz, formerly chief design engineer for the Traylor Engineering & Manufacturing Company of Allentown, Pa., was recently appointed to the position of chief engineer of that company.

During his 15 years with the company, Mr. Mertz has designed much of the equipment manufactured by Traylor, as well as plant installations for many nonmetallic mining companies and cement and lime concerns.

M. O. Stockland, Jr.

Consolidation of the Four Wheel Drive sales promotion department and advertising department under the managership of M. O. Stockland Jr., was announced this week by the officials of the company.

Mr. Stockland has served as sales promotion manager since the organization of that department early in 1946. He has been associated with F.W.D. since 1922.

Henry Rowold was recently appointed assistant general sales manager of Mack-International Motor Truck Corporation. Mr. Rowold is also a vice-president of the company.

Ken O. Hood has been appointed the new Pacific Coast district manager for the Falk Corporation, Milwaukee, Wis. His headquarters will be in Los Angeles.

Paul R. Pollock has been named manager of the Denver, Colo., office of the Allis-Chalmers Mfg. Co., according to an announcement by J. L. Singleton, manager of district offices.

R. H. Morse, Jr., vice-president and general sales manager of Fairbanks, Morse & Co., Chicago, recently announced the appointment of John A. Cuneo as manager of the company's Los Angeles branch, succeeding Harry W. Brown, who has retired.

Hewitt Rubber Division of Hewitt-Robins, Inc., has appointed Ellis & Lowe Company as a new distributor for Hewitt's industrial rubber products in the Tampa, Fla., area.

International Harvester Company has announced the establishment of a separate motor truck branch at Omaha, Nebr., with J. D. Richardson in charge.

E. R. Schaefer

Edgar R. Schaefer, executive vice-president of the Gardner-Denver Company, was elected company president and H. G. Myers, former president, became chairman of the executive board at the annual stockholders meeting held March 28 at Quincy, Ill.

Mr. Schaefer became affiliated with Gardner-Denver in 1919. He was made a vice-president in 1926.

In line with the policy of the continuing development of its already strong position in the process equipment field, the General American Transportation Corporation of Chicago has acquired The L. R. Christie Company of New York City, for more than 40 years builders of industrial dryers, calcinators and coolers.

The Christie line will complement General American's wide variety of drying, dewatering and cooling machinery, presently represented by the various types of Louisville Dryers and American Drum Dryers, and will contribute to the development of better methods for the large volume processing of various types of organic and non-organic materials.

Floyd Jones

The appointment of Floyd Jones as sales manager of the portable compressor division of the Davey Compressor Co., Kent, O., was announced recently by Paul H. Davey, president.

Mr. Jones, who was formerly Davey's northeastern district manager, has had more than 30 years of construction equipment experience.

Rayon is now being used as the reinforcement or tension member of all its light-duty and automotive V-belts, it has been announced by the B. F. Goodrich Company, Akron, O. (Tension members are the parallel groupings of cords which carry the load in a V-belt.)

The new rayon construction, as compared to the cotton previously used is said to give longer belt life, particularly at elevated temperatures, which are becoming an increasing factor in this field, as belt speeds and loads are increased.

The Azbe Corporation has announced the opening of its new offices at 3135 Forsythe Boulevard, Clayton, St. Louis 5, Mo., which took place on March 8.

The Birmingham office of the Robins Conveyors Division was recently consolidated with that of the Hewitt Rubber Division, both of Hewitt-Robins Inc. The Birmingham office has been located at 615 North 9th Street.

HOW NAYLOR PIPE OFFERS YOU The Means to Any End

Although Naylor pipe is light-weight pipe, Naylor's wide variety of standard-weight ends enables you to use Naylor pipe with fittings and equipment common to industry. It is possible to change connections quickly from one type to any other as required. By careful selection of the Naylor coupling best-suited to your job, you can save time, work and money.

A section of the Naylor Catalog provides helpful information on the subject of pipe connections. If you have not already received a registered copy of Naylor Catalog, No. 44, it will pay you to write for it today.

Naylor

NAYLOR PIPE COMPANY
1257 East 92nd Street • Chicago 19, Illinois
New York Office: 350 Madison Avenue • New York 17, N. Y.

Break your finish grinding BOTTLENECK today

TDA can increase finish grinding capacity as much as 30% with your present equipment. TDA's flexibility assures immediate increased production without a large capital investment and facts—based on field experience—prove the capacity of TDA to increase finish mill production of normal or special cements. Our engineers will be glad to show you what TDA can do in your plant. ★

DEWEY AND ALMY CHEMICAL COMPANY

CHICAGO, ILL. ★ CAMBRIDGE 40, MASS ★ OAKLAND, CAL.

IF YOU HAVE A DRY PROCESS PLANT AND RAW GRINDING IS A BOTTLENECK . . . TRY **RDA**

E. B. Hill

E. B. Hill, who was formerly district manager of the Gar Wood general line in Chicago, has been named director of factory sales for the firm.

In his new post he will supervise all factory sales activities, including those of the company's Buckeye Traction Ditcher and St. Paul Hydraulic Hoist Divisions.

F. C. Bond, who was until recently director of research in charge of the basic industries laboratory of the Allis-Chalmers Manufacturing Company, has been made technical director of the department. He has been succeeded in his former position by S. D. Michaelson.

Peter J. Massey, general manager of the Kalamazoo, Mich., mill of the St. Regis Paper Company, was awarded the gold medal of the Technical Association of the Pulp and Paper Industry for his "outstanding contribution to the technical advancement of the industry."

Hendrick Manufacturing Company Carbondale, Pa., perforated and fabricated metal producer, has appointed the following new sales representatives: A. H. Patten (Patten Engineering Company, Denver) for Colorado, Utah, Wyoming, Montana and southern Idaho; Fred G. Greaves Company of Seattle for Washington, Oregon and northern Idaho; and Orville B. Ackerly Jr. of San Francisco for northern California and the Reno section of Nevada.

The Shovel and Crane Division of Lima Locomotive Works, Incorporated, Lima, O., has announced the appointment of M. E. Army and Ralph Rodgers as assistant district managers of the Pacific Coast district. Mr. Army will continue to make his headquarters with Smith Booth Usher Company, 2001 Santa Fe Avenue, Los Angeles, and Mr. Rodgers will have his office with Paul Fenwick, district manager for the Lima Company with offices at 1315 Howard Street, San Francisco.

The appointment of James P. Bates as chief metallurgist for the Hyster Company at Portland, Ore., has been announced by Maurice Hooff, production manager. Mr. Bates will be in charge of materials specifications and heat treating for the company's three plants—Portland, Ore., and Peoria and Danville, Ill.

International Harvester Company has announced the appointment of B. M. Kaiser as Southwest district manager of motor trucks, replacing J. T. Sullivan. Mr. Sullivan has been transferred to the Eastern district in the same capacity.

Howard P. Claussen, vice-president and director of the cotton department of Bemis Bro. Bag Co., Boston, has been elected a vice-president of the Cotton Textile Institute.

The International Harvester Company has announced the establishment of separate motor truck branches at Columbus, O.; Fort Wayne, Ind.; Little Rock, Ark.; and Davenport, Ia. General line branches, which handle the company's farm machinery, tractor and refrigeration lines, will continue at those points also.

In making this announcement W. K. Perkins, manager of sales of the company's motor truck division, also announced the appointment of J. L. Teach as manager of the Columbus motor truck branch, W. J. McCahill as truck branch manager at Fort Wayne, H. H. Hedges Jr. as manager of the Little Rock truck branch and C. E. Cheney as manager of the Davenport truck branch.

After 47 years of achievement in magnetic engineering and manufacturing, the Dings Magnetic Separator Company recently moved into a new plant in Milwaukee's southwestern industrial district. By this move the firm centralized all manufacturing activities which were previously carried on in two Milwaukee plants. New equipment and machine tools have been installed throughout.

George R. Homer has been named sales engineer in San Paulo, Brazil, by the Ingersoll-Rand Co., Phillipsburg, N. J. Mr. Homer is graduate of the Mackay School of Mines, and was chief engineer of the destroyer *McCook*, which saw duty in the Atlantic and the Pacific.

Due to steadily increasing business, the C.I.T. Corporation has found it necessary to occupy enlarged offices at One N. LaSalle St., Chicago, which were formally opened on February 17. C.I.T. has geared its facilities to meet present and future financing requirements of the construction industry.

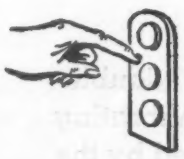
The following officers were elected by the Internal Combustion Engine Institute at its annual meeting in February: president, E. V. Oehler, Briggs & Stratton Corporation, Milwaukee; vice-president, J. M. Dolan, Le Roi Company, Milwaukee; secretary, W. B. Taylor, Minneapolis-Moline Power Implement Company, Minneapolis; treasurer, H. W. Smith, Caterpillar Tractor Company, Peoria, Ill.

Recently elected to offices by the directors' board of the American Hoist & Derrick Company, St. Paul, Minn., are the following: Frederic Crosby, chairman of the board and executive committee; Harold O. Washburn, president; Stanley M. Hunter, vice-president of sales; Donal B. Botkin, vice-president of manufacturing; James F. Bishop, secretary and treasurer; Robert J. Henry, assistant secretary.

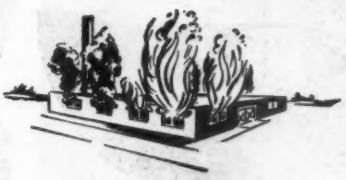
I was looking ahead when I bought a 3½ H.P. AIRCOOLED Sheppard Diesel

THERE ARE *cheaper engines. But, the rugged little Sheppard will be going strong long after the others would have worn out.*

NO ELECTRICAL IGNITION . . . *no carburetor . . . means a minimum of servicing and lower maintenance costs. Looking ahead over a period of years — that's important.*



BEING A FULL DIESEL, *the Sheppard starts easily and operates efficiently on low-cost domestic furnace oil. It produces no harmful or explosive fumes.*



I LOST *a plant when a spark ignited a fume-filled room. It won't happen again . . . not with the Sheppard on the job. That protection alone more than justifies its cost.*

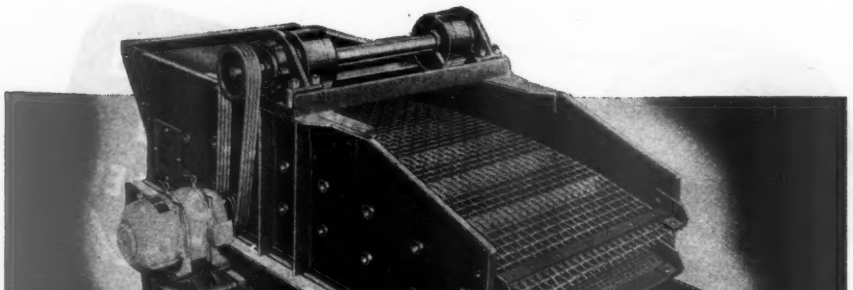
The model 14 Aircooled Sheppard is available as a power unit or direct connected to a 2,000 watt generator. See it at your nearest Sheppard Distributor. We will forward his name on request. Also literature with complete specifications available.

R. H. SHEPPARD CO., INC.
13 Middle St., Hanover, Pa.

Sheppard DIESEL

DIESEL'S THE POWER . . .
Sheppards' the Diesel

Generating Sets • 2,000 to 36,000 watts
Power Units • 3½ to 56 continuous H. P.



Superior Performance
Minimum Maintenance
...for 9 Years

The 4′ x 6′ double-deck Plat-O Vibrating Screen, operated by the Cerulean Stone Company, Cerulean, Ky., has been doing a superior screening job for nine years. While the screen has handled commercial gravel of all kinds during this period, the only repairs have been on the ½" and ⅜" screen cloth, and the replacement of one bearing.

The rugged design and construction that assures minimum maintenance throughout long service life is only one of many reasons why Deister Machine Company products are popular with stone and aggregates producers. Proved dependability, faster grading, and more accurate sizing have made Plat-O tops with operators all over the world. Write for details on the Plat-O Vibrating Screens.

DEISTER MACHINE COMPANY
FORT WAYNE 4, INDIANA

V. E. McMullen has been named executive vice-president of the Cummins Engine Company, Inc., and R. E. Huthsteiner vice-president and general manager. Mr. McMullen has been serving as vice-president and general manager. Prior to his promotion, Mr. Huthsteiner was assistant general manager and controller.

Burton Ford

St. Regis Paper Company, New York, announced today the formation of a new sales district in its multiwall bag division, effective February 1, 1947. The district will cover Pennsylvania, with the exception of Philadelphia. It will be known as the Mid-Atlantic District, will have its headquarters in Allentown, Pa., and will be under the supervision of Burton A. Ford, vice-president of the St. Regis Sales Corporation.

Mr. Ford will continue his close contact with the lime and fertilizer producers, and will represent the St. Regis Paper Company and the St. Regis Sales Corporation at the periodic meetings of these industries.

Bemis Bro. Bag Company's film, "The King's Other Life," portraying the various processes involved in making industrial cotton bags, recently had its premiere in St. Louis, Mo. The movie is a 16 mm., 20-minute feature in color, with sound effects. It required six months to shoot the sequences and prepare the film for the screen.

George Abbot Morison has resigned from his duties as vice-chairman of the board of the Bucyrus-Erie Company, South Milwaukee, Wis., to make his home in New Hampshire. Mr. Morison will continue his connection with Bucyrus-Erie as a member of the executive committee of the board of directors. He has been affiliated with the company since 1901.

Three important changes in the top management of The Goodyear Tire & Rubber Company have been announced.

Clifford Slusser has resigned as vice-president in charge of production and as a member of the board of directors. He will continue with the company as vice-president and general manager of the subsidiaries which operate Goodyear's domestic textile plants and coal mines.

Mr. Slusser is succeeded in his former offices by Russell DeYoung, who has been vice-president and general manager of Goodyear Aircraft Corporation, a subsidiary.

Fred W. Climer was elected to a new vice presidency of the parent company in charge of industrial relations.

William C. Champion, district manager of the Pacific Northwest Territory, for the Lima Locomotive Works, Inc., Lima, O., at Seattle, died on April 4.

Legal Decisions

By LEO T. PARKER
Attorney at Law

Purchaser Breaches Contract

According to a recent higher court a seller of sand and gravel may recover full damages for breach of a contract by a general contractor or other purchaser. Thus a contractor is liable who fails to perform an agreement to furnish sufficient base grade on which the seller can spread and compact a specified number of cubic yards of gravel a day. This is so because the contractor's failure to furnish sufficient base grade puts the seller to additional expense and he is entitled to recover the amount of these additional expenses.

For example, in *Brady* v. *Central Excavators, Inc.*, 25 N. W. (2d) 630, reported March, 1947, it was shown that a sand and gravel company acted as a subcontractor and sued a general contractor for damages contending that the latter breached his contract to furnish, or have furnished streets and drives "in sufficient quantity in area per day so as to utilize the 1000 cubic yards of gravel per day."

The subcontractor claimed that in reliance upon the general contractor's promise, he secured the facilities and hired the labor necessary to complete the work at the rate of 1000 cubic yards per day. The subcontractor contended that as the result of this breach he was required to do additional work not contemplated by the agreement, for which he was entitled to extra payment. The higher court allowed the subcontractor, or seller of the sand and gravel, $26,446 damages. This court said:

"There is no doubt that plaintiff (subcontractor) is entitled to recover for any extra work ordered by defendant (general contractor) and not covered by the purchase order."

Also, see *Indianapolis Company* v. *Brennan*, 74 Ind. 1. Here the owner obligated the contractor to complete the work by August 15. The owner delayed the contractor. The higher court allowed the contractor heavy damages and said:

"Certainly, when appellant company (owner) obligated these parties (contractor) to do and finish the work within a fixed period, it was its duty to afford them a fair and reasonable opportunity to begin and complete the work. Its (owner's) default or failure in these respects would subject it to liability for whatever damages appellees (contractor) might reasonably sustain on that account."

For comparison see the United States Supreme Court case of *United States* v. *Howard P. Foley Company*, 67. S. Ct. 154. In that case, a contracting firm had agreed to complete its part of the construction of an airfield in 120 days but was delayed an additional 157 days because of the unstable sub-soil conditions encountered, and sought to recover damages from the federal government for the extra cost sustained because the government had delayed completion of the work.

However, this contract contained a clause stating that the government *need not maintain conditions* that would enable the contractor to complete its work in 120 days, but on the contrary contained clauses that indicated *a delay might be encountered.*

In view of this clause the higher court held the government *not* liable for extra cost to the contractor caused by the delay.

Statute of Frauds

It is well established law that all verbal contracts for sale of real estate, or for a lease over one year, are *absolutely* void under the Statute of Frauds. This is universal law in all states.

In *Fletcher* v. *Blair*, 178 S. W. (2d) 322, a property owner leased a building for a period of two years. This contract was *verbal.* At the end of the first year the property owner evicted the tenant, who sued for damages. The higher court refused to allow damages, and said:

"If the Statute of Frauds did apply to the oral two year lease then the tenant could not recover compensatory damages for the second year, either on the theory of breach of contract or in tort."

Zoning Ordinance

According to a recent higher court if a company is established in business, new city zoning ordinances will not prevent the company from building new structures or additions.

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The above photograph shows a 110 ft. diam. Hardinge Center Pier "Auto-Raise" Thickener. Note that the scraping mechanism consists of rakes near the end of the arms with double spirals near the center. The spirals remove the settled solids in one revolution, thereby preventing an accumulation of solids at the center of the tank.

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Write for Bulletin 31-D

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For example, in *Piccadilly Company v. Board of Com'rs of Town of Belleville,* 46 Atl. (2d) 563, it was shown that a company has since 1924 operated its business in a concrete and brick building. In 1945 the company desired to build a new building. A permit was refused by the city officials on the grounds that the zoning ordinance had been changed recently, and the premises were zoned as residential.

The company filed suit and the higher court ordered the city officials to issue the permit, saying:

"It is plain that the prosecutor (company), having established a business already for the purposes above named, is immune to interference therewith by any zoning regulations."

Insurance Policy Broadly Construed

In all legal controversies involving insurance policies, the courts *broadly* construe the policy *in favor* of the insured. See the late and leading case of *Ehrke* v. *North American,* 24 N. W. (2d) 640, which upheld this principle of law. In this case the insured became sick and had considerable hospital expenses. The insurance company refused to pay the hospital bill on the contention that the only loss on account of sickness which it *intended* to insure was sickness resulting from an accident. The higher court broadly construed the policy to include sickness from natural causes.

Widow Draws Compensation

According to a recent higher court the state is obligated to pay compensation to a deceased employee's widow for the full remainder of the compensable period.

For illustration, in *C. & G. Potts & Company* v. *Fortney,* 69 N. E. (2d) 752, reported February, 1947, it was shown that an employee became disabled from the occupational disease known as "silicosis-tuberculosis," which arose out of and in the course of his employment. A state law provided for compensation payments to the employee for 300 weeks. The employee died after drawing compensation for 200 weeks. The higher court held that his widow was entitled to compensation for 100 additional weeks.

Discharge of GI

In *Basham* v. *Virginia Company, Inc.,* 66 Fed. Supp. 718, a GI sued on account of *alleged* wrongful discharge contrary to the Selective Training and Service Act.

The Federal Court refused to hold that the GI was illegally discharged where the testimony proved that the ex-serviceman's conduct was such that he "grudgingly" performed the duties of his job. Also, witnesses testified that he often used profane and vulgar language in the presence of customers of his employer.

Other testimony showed that he refused to obey orders given by his employer.

Child Gets Caps

The general rule is that one who keeps or uses explosives must exercise a high degree of care to prevent injury to all but trespassers.

For illustration, in *Lawrence* v. *King*, 197 S. W. (2d) 548, reported February, 1947, it was shown that a property owner left some dynamite caps in a tool house and failed to give warning of the presence of the dangerous explosives in the tool house. A child went into the tool house, got the caps and carried some of the dynamite caps in his pocket for several days. Later he took one of these caps out of his pocket and it exploded, causing the loss of one thumb and one eye. The child's father sued the property owner for damages. The higher court refused to allow any damages, saying:

"We cannot see how this box so placed could do any harm or how it could be anticipated that a child would meddle with it. Here, in order for the boy to obtain the caps, it was necessary for him to go into the private possession to obtain the dangerous explosives."

Questions and Answers

[Mr. Parker will be glad to answer questions regarding legal problems of PIT AND QUARRY readers. Questions should be addressed to Leo T. Parker, Legal Editor, PIT AND QUARRY.—Ed.]

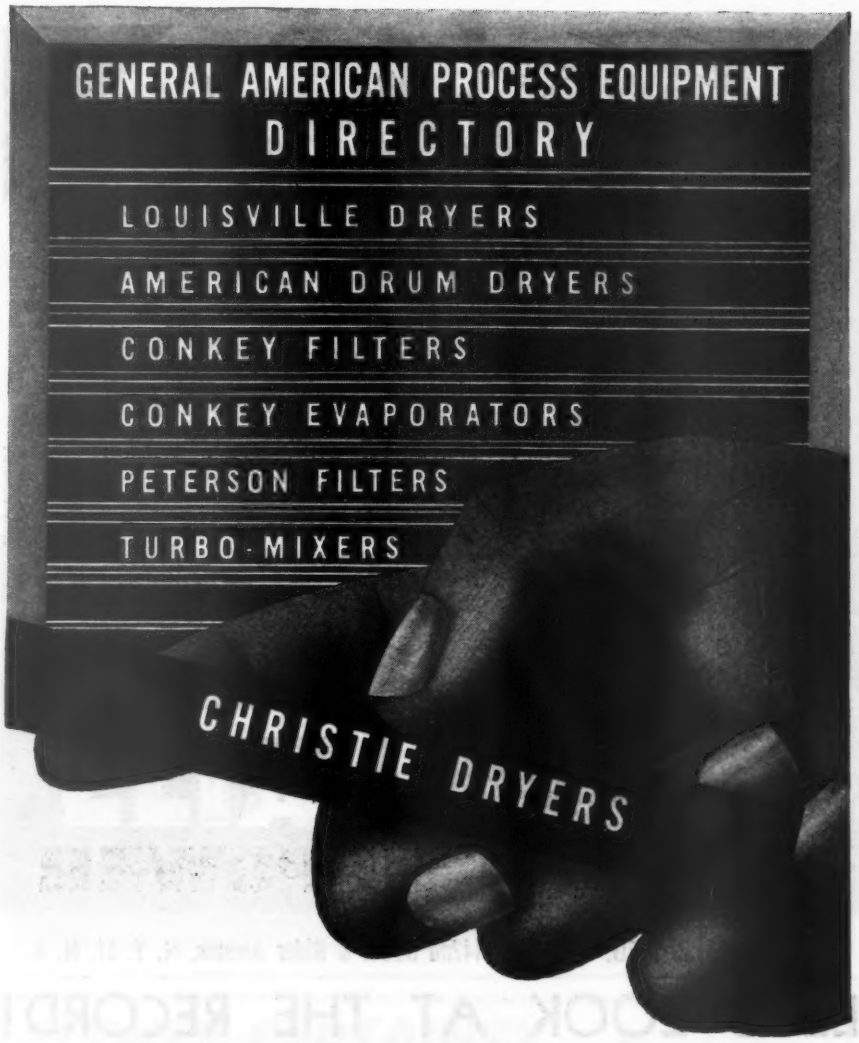
Legal Editor, PIT AND QUARRY: We are a small sand and gravel company and have always worked our men up to 56 hours per week without paying them overtime. We do sell gravel that is used by railroads, highways, and the like, and also sell to producers of pipe and blocks that ship out of the state, but the majority of our products are used in our state.

Now the U. S. Dept. of Labor tells us that, effective March 15, 1945, we must pay overtime after 40 hours, except for a period of 14 weeks in a year, during which time overtime applies after 56 hours. They go into a prolonged discussion of the Walling Ruling and say that although the courts reversed themselves on it, the Administrator has ruled that all concerns must now come under Section 7(a)3 and pay overtime after 40 hours.

We certainly do not wish to pay back wages unless we have to. Our employees are satisfied, which is the important thing. Bichler Brothers.

Answer: According to a recent higher court you are within scope of the Fair Labor Standards Act. Also, the Supreme Court of the United States has held that such companies as yours must pay wages specified by the Fair Labor Standards Act. However, I advise you to consult a local lawyer so that he can represent you in making the settlement. For several years the writer has been warning readers to *know* how they stand on various subjects, particularly the Fair Labor Standards Act. Sorry you did not have opportunity to read my briefs of higher court decisions, many of which specifically cover your case.

The Pit and Quarry Handbook and Directory are the only ones in the nonmetallic minerals industries; the most complete in any industry.



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CENTRAL FREIGHT ASSOCIATION DOCKET

Docket 82828 (2)—Stone, crushed, stone screenings, and agricultural limestone (not ground or pulverized), in bulk, in open-top cars, straight or mixed carloads, minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Eckerty, Ind., to Evansville, Ind., 94 cents; Fort Branch, Haubstadt, Ind., 105 cents; Johnson, Poseyville, Ind., 110 cents; Velpen, Ind., 72 cents; Winslow, Ind., 77 cents net ton, subject to Ex Parte 162 increase.

Docket 82832 (2)—Stone, fluxing, furnace or foundry, melting or refractory (unburned), in bulk, in open-top cars, carload minimum weight 90 percent of marked capacity of car furnished, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Carey, O., to Clarksburg, Grafton, W. Va., 231 cents net ton, subject to Ex Parte 162 increase.

Docket 82833 (2)—Sand (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica) and gravel, in open-top cars only, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Lafayette, Ind., to Kokomo, Ind., 62 cents net ton; subject to Ex Parte 162 increase.

Docket 82851 (1)—Crushed stone in bulk, in open-top cars, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacitly, actual weight will apply. Establish on from Georgia, Ind., to Anderson, 132 cents; Lafayette, 132 cents; Auburn, Ind., Kendallville, Ind., 165 cents; Columbus, Ind., 105 cents; Indianapolis, Ind., 121 cents; Kokomo, Ind., Muncie, Ind., 138 cents; Marion, 143 cents net ton, subject to Ex Parte 162 increase.

Docket 82856 (2)—Slag, commercial crushed (a product of iron and steel blast or open hearth furnaces), in open-top cars, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to cubical or visible capacity, actual weight will apply. Establish on from Youngstown, O., to Dayton, O., 182 cents; Hamilton, O., 204 cents net ton, subject to Ex Parte 162 increase.

Docket 82866 (1)—Sand and gravel, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Gosport, Ind., to Freetown, 105 cents; Heltonville, 99 cents and Colitic, Ind., 94 cents net ton, subject to Ex Parte 162 increase.

Docket 82907 (1)—Crushed stone, in bulk in open-top cars, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Speed, Ind., to Armstrong, Ind., 132 cents net ton, subject to Ex Parte 162 increase.

Docket 82925 (2)—Sand, all kinds and gravel, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Glass Rock, O., to Perrysville, O., 138 cents net ton, subject to Ex Parte 162 increase.

Docket 82948 (1)—Sand, all kinds, and gravel in open-top cars, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Columbus, O., to Cumberland, O., 127 cents; Senecaville, O., 116 cents net ton, subject to Ex Parte 162 increase.

Docket 83036 (1)—Gravel in open-top cars, carload minimum weight 90 percent of marked capacity of car, except that when car is loaded to full cubical or visible capacity, actual weight will apply. Establish on from Montezuma, Ind., to Milligan, Ind., 44 cents net ton, subject to Ex Parte 162 increase.

ILLINOIS FREIGHT ASSOCIATION DOCKET

Docket IRC 511-576—Agricultural limestone, carload, from Rivermines, Mo., to (representative):

	Rates in cents per net ton	
	Proposed	Present
Tamalco, Ill.	125	123
Walshville, Ill.	125	128
Litchfield, Ill.	130	128
Jacksonville, Ill.	132	128
Beardstown, Ill.	139	188

Meeting April 8, 1947.

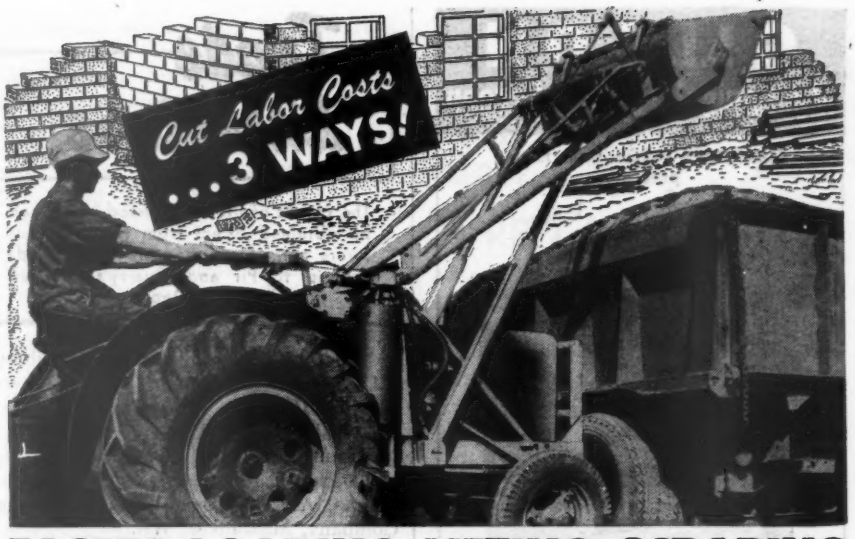
TRUNK LINE ASSOCIATION DOCKET

Docket 44068 (shippers)—Rip rap or broken stone, carload minimum weight 90 percent of marked capacity of car, etc., from Peddicord Siding, Baltimore, Md., to Oxford, Md., $1.76 per net ton (subject to Ex Parte 162 increase). Reason: Comparable with rates applying from and to other points.

Docket 44077 (shippers) — Limestone, broken, crushed, ground or pulverized, carload, minimum weight 30,000 pounds, from Pleasantville, N. Y., to Wakefield, Mass., $2.75 per net ton (subject to Ex Parte 162 increase), in lieu of current sixth class rate. Reason: On same basis as rates applying from and to other points.

WESTERN TRUNK LINE NEW APPLICATIONS

Docket E-41-843—Sand, moulding, bonded (naturally or otherwise) in all kinds of equipment, carload minimum weight will be 90 percent of the marked capacity of the car, except that when car is loaded to full visible or cubical capacity, actual weight will apply; but orders will not be accepted for closed and open-top cars of less marked capacity than 60,000 pounds and 80,000 pounds respectively, from Dousman, Wis., to Houghton, Mich. Proposed—275 cents net ton.



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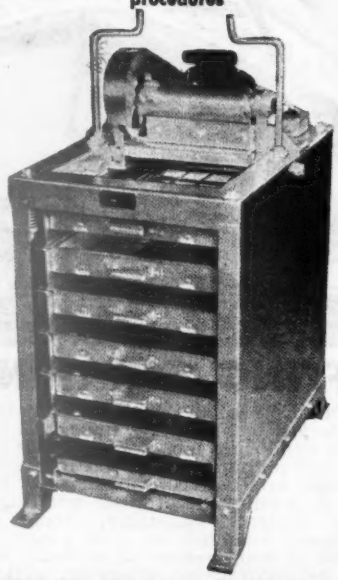

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Trade Literature

The pieces of literature listed below can be obtained direct from the manufacturers named, or requests can be addressed to Pit and Quarry's "Service to Readers" Department.

MS-402A. 24-page catalog describing HD-10 diesel tractor. Allis-Chalmers Tractor Division, Allis - Chalmers Mfg. Co., Milwaukee 1, Wis.

HANDBOOK B6452. 16 pages. Describes eight classifications of electrical equipment. Allis - Chalmers Manufacturing Company, Milwaukee, Wis.

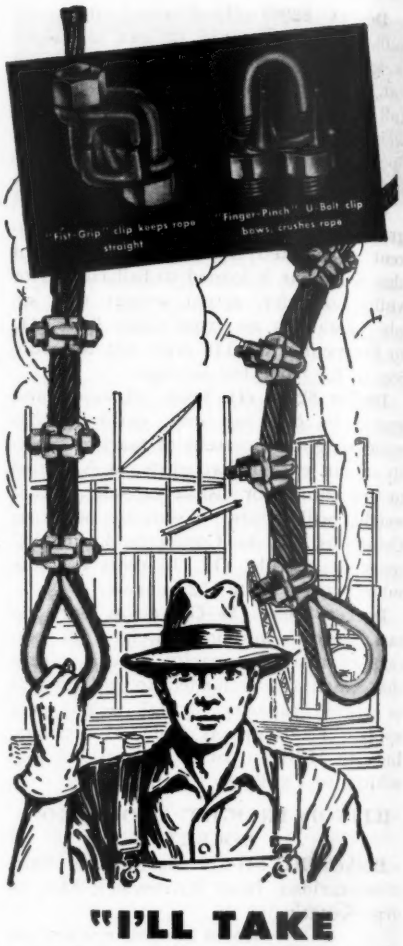
PREFORMED WIRE ROPE. 24 pages. Preformed Wire Rope Information Bureau, 520 North Michigan Avenue, Chicago 11.

SELF - CONTAINED ELECTRIC HOISTS. Bulletin No. A-407. 31 pages. Vulcan Iron Works, Wilkes-Barre, Pa.

ROBINS CLIPTEX SCREEN. Bulletin 111-A. 12 pages. Robins Conveyors Incorporated, Passaic, N. J.

SOMETHING NEW—605 KOEHRING EXCAVATOR. Folder. Koehring Company, Milwaukee 10, Wis.

B. F. GOODRICH VIBRO-INSULATORS. The B. F. Goodrich Company, Industrial Products Division, Akron, O.



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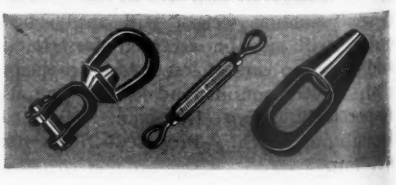

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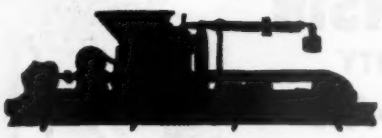

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PRACTICAL INFORMATION ON DUST COLLECTION. Bulletin FY-142. 14 pages. Whiting Corp., Harvey, Ill.

PREFERRED UNIT STEAM GENERATOR. Bulletin No. 1000-E. Preferred Utilities Manufacturing Corp., 1860 Broadway, New York 23, N. Y.

LUBRICATION OF DIESEL ENGINES. Form A-1344 5M 7-46. 48 pages. Sun Oil Co., Industrial Products Dept., Philadelphia 3, Pa.

MANGANESE STEEL, THE TOUGHEST STEEL KNOWN FOR CEMENT MILL EQUIPMENT. Bulletin 1043-CM. 36 pages. American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.

THE A. B. C. OF SYNCHRONOUS MOTOR CONTROL. 19 pages. Electric Machinery Mfg. Company, Minneapolis 13, Minn.

PHILADELPHIA SPIRAL-BEVEL SPEED REDUCERS. 56 pages. Philadelphia Gear Works, Inc., Erie Ave. and G St, Philadelphia 34, Pa.

SYNTRON VIBRATORY MATERIAL HANDLING EQUIPMENT. Catalogue 466. 76 pages. Syntron Company, Homer City, Pa.

WHEN IT'S POWER YOU NEED. 15 pages. Caterpillar Tractor Co., Peoria, Ill.

PRODUCTS FOR HEATING. 12 pages. Allis-Chalmers, Milwaukee, Wis.

BALDWIN. 32 pages. Baldwin Locomotive Works, Philadelphia, Pa.

ROTO-CLONE DYNAMIC PRECIPITATOR. Bulletin No. 272A. 19 pages. American Air Filter Company, Inc., Louisville, Ky.

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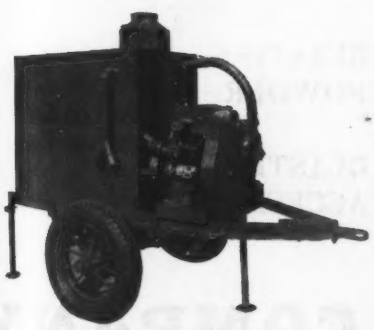

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BUILDERS RECORDING, INDICATING, CONTROLLING INSTRUMENTS. Bulletin 359. 4 pages. Builders-Providence, Inc., Division of Builders Iron Foundry, Providence 1, R. I.

LIMA TYPE 802. Bulletin 82-A. 20 pages. Lima Locomotive Works, Inc., Shovel and Crane Division, Lima, O.

MORROW HANDBOOK FOR USERS OF PERFORATED METAL SCREENS. Bulletin 70. 52 pages. Morrow Manufacturing Company Division, The Wacker Corporation, Wellston, O.

A FUTURE WITH A PAST. 11 pages. Caterpillar Tractor Company, Peoria, Ill.

"CATERPILLAR" DIESEL ELECTRIC SETS. 20 pages. Caterpillar Tractor Company, Peoria, Ill.

BRISTOL TACHOMETERS. Bulletin S1400. 12 pages. The Bristol Company, Waterbury 91, Conn.

FOUR WHEEL DRIVE TRUCKS FOR HEAVY DUTY SERVICE. 8 pages. Bulletin No. 461. The Four Wheel Drive Auto Co., Clintonville, Wis.

I.C.C. REGULATIONS APPLICABLE TO PRIVATE MOTOR TRUCKS. 105 pages. Manual. National Council of Private Motor Truck Owners, Inc., National Press Building, Washington 4, D. C.

GASOLINE AND DIESEL INDUSTRIAL WHEEL TRACTORS. 24 pages. Catalog form A-103-JJ. International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.

ECONOMY PUMPS, INC. 8 pages. Catalog No. B 1146. Economy Pumps, Inc., Hamilton, O.

CHAIN BELTS FOR EVERY INDUSTRY. 10 pages. Bulletin No. 46-10. Chain Belt Company, 1600 W. Spruce Street, Milwaukee 4, Wis.

WELDMOBILE. 4 pages. The Hobart Brothers Company, Hobart Square, Troy, O.

MATERIAL-HANDLING HANDBOOK. 4th edition. 56 pages. The Electric Industrial Truck Association, 208 S. LaSalle Street, Chicago 4, Ill.

FLOTATION REAGENTS, 1947. Mineral Dressing Notes, No. 15. American Cyanamid Company, Mineral Dressing Division, 30 Rockefeller Plaza, New York 20, N. Y.

LUBRICATION OF THE PORTABLE AIR COMPRESSOR. *Lubrication*, May, 1947. The Texas Company, 135 E. 42nd Street, New York 17, N. Y.

SOME SAFETY PRACTICES FOR METAL MINES, NONMETAL MINES (OTHER THAN COAL), MILLS, METALLURGICAL PLANTS, AND QUARRIES. *Compiled under the direction of Dr. R. R. Sayers, director of the U. S. Bureau of Mines, Washington 25, D. C. Available without charge.*

The purpose of this publication is to make standard safety practices available for the non-coal branches of the mineral industry, with the hope that they may assist in reducing accident occurrence. It contains safety suggestions relating to the following: operation of mills, open pits, quarries, surface excavations; installation and operation of head frames, hoists, mine cages and shafts, and other related equipment.

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Design features of this 36 x 30 E stone crusher include: (1) Meehanite frame, sectionalized when necessary; (2) removable water cooled bearings; (3) improved design of swing jaw bearing; (4) force-feed oil lubrication, or circulating system if desired; (5) split flywheels; (6) flat or V-belt drive.

Write for further details or engineering help. BA-1

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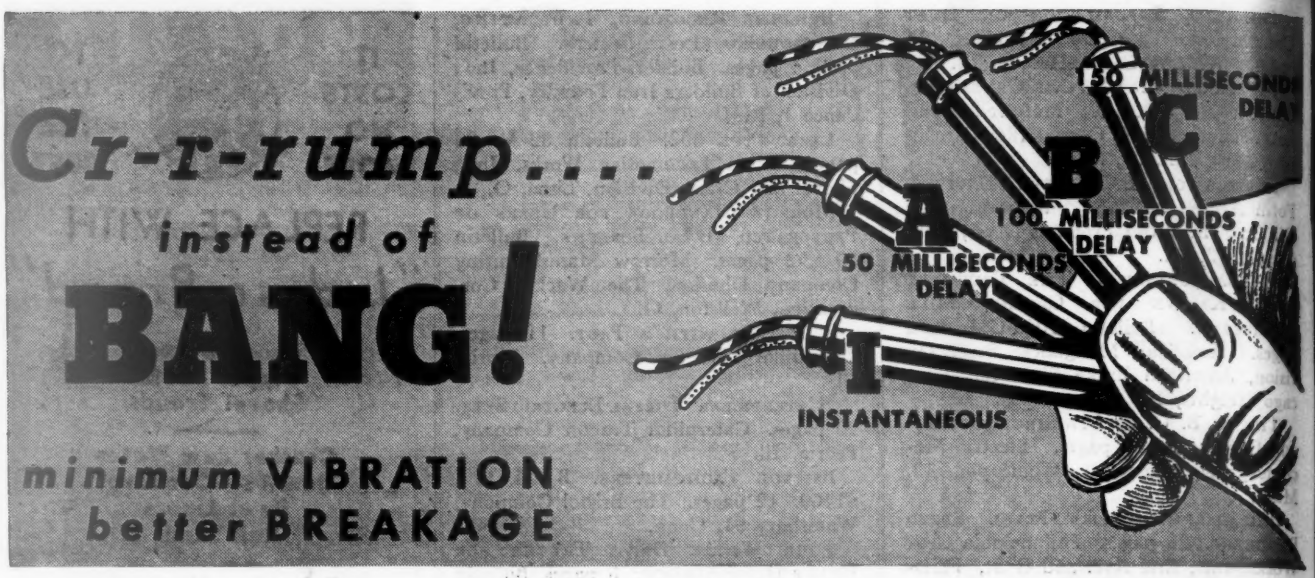
ANSONIA, CONNECTICUT



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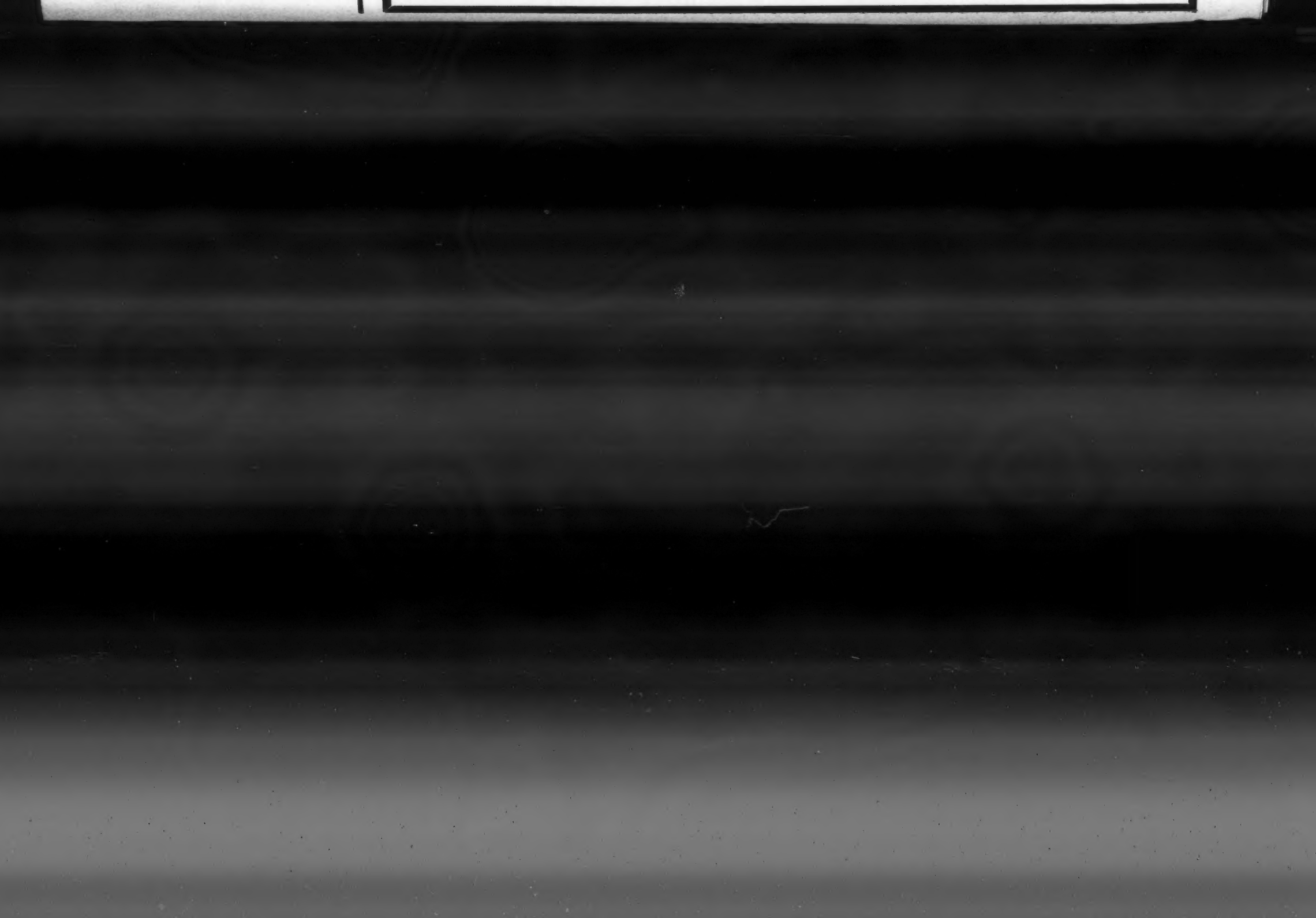
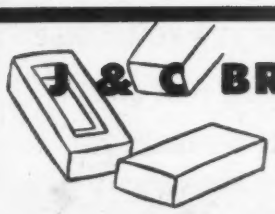


PIT AND QUARRY

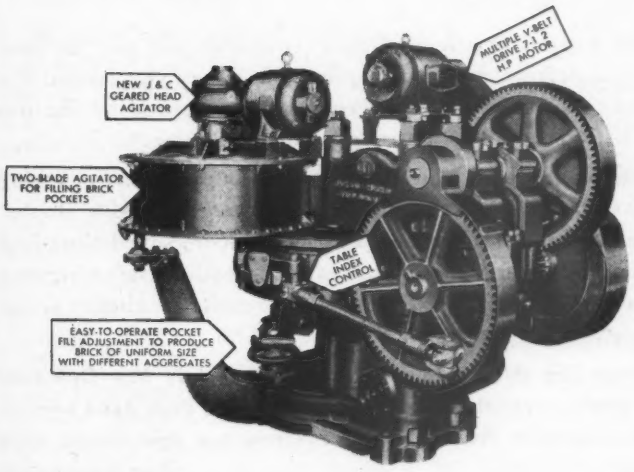
CONCRETE MANUFACTURER

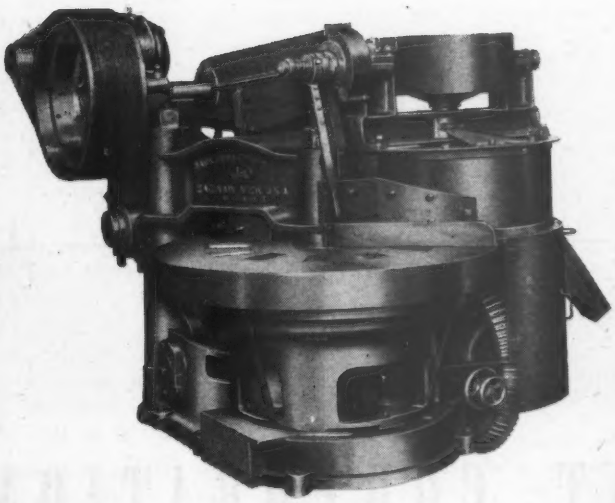


J & C BRICK MACHINES TURN OUT MORE AND

Better Brick

. . . FASTER AND EASIER


NEW J & C GEARED HEAD AGITATOR
MULTIPLE V-BELT DRIVE 7½ H.P. MOTOR
TWO-BLADE AGITATOR FOR FILLING BRICK POCKETS
TABLE INDEX CONTROL
EASY-TO-OPERATE POCKET FILL ADJUSTMENT TO PRODUCE BRICK OF UNIFORM SIZE WITH DIFFERENT AGGREGATES



You can get up to 14,000 high quality sand lime or concrete brick per 8-hour shift with the new J & C Model NC Brick Machine (left). Utilizing 75-ton pressure in a continuous molding cycle, the Model NC turns out either solid or frog-type brick with clean, sharp edges—square corners—smooth faces free from blemishes—the kind of brick contractors demand because it enables masons to lay up strong, good-looking walls in record time. No pallets are necessary. Six hardened steel lined pockets, easily adjusted in depth. Low-cost flat deck platforms. Automatic feed control from hopper to agitator. Modern geared head design.

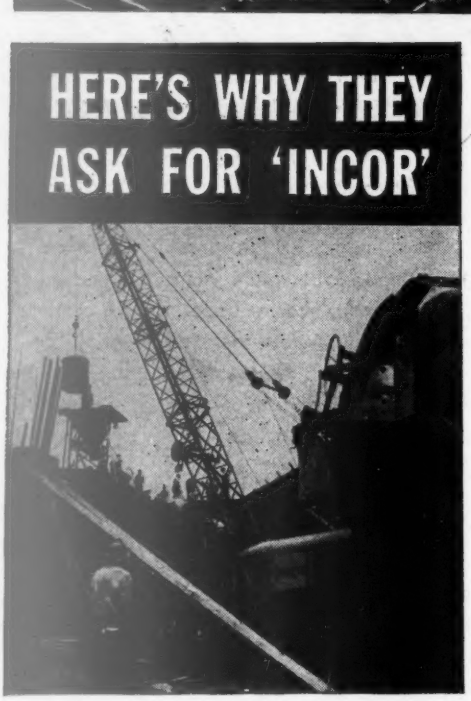
Similar in principle to the Model NC but built for double the production, the new and improved J & C Model A Brick Machine (lower left) produces up to 28,000 brick per 8-hour day. That's approximately 60 brick per minute—one a second!—and every one is formed clean, sharp-edged, and free from blemishes by the unusually high pressure applied to the aggregate in the 12 pockets.

For faster, easier production of better brick at minimum cost, it will pay you to investigate J & C Brick Machines. Write for particulars.

JACKSON & CHURCH CO.
SAGINAW, MICHIGAN

WORK WELL DONE SINCE '81

HERE'S WHY THEY ASK FOR 'INCOR'



New York City Fire Dept. Repair Shop, Long Island City. City of New York, Department of Public Works; Architects: A. G. Lorimer, former Chief; A. J. Daidone, present Acting Chief, Bureau of Architecture. Engineers, Roberts & Schaefer Co., Chicago. Ready-Mix Concrete, Central Concrete, Inc., Brooklyn, N. Y.

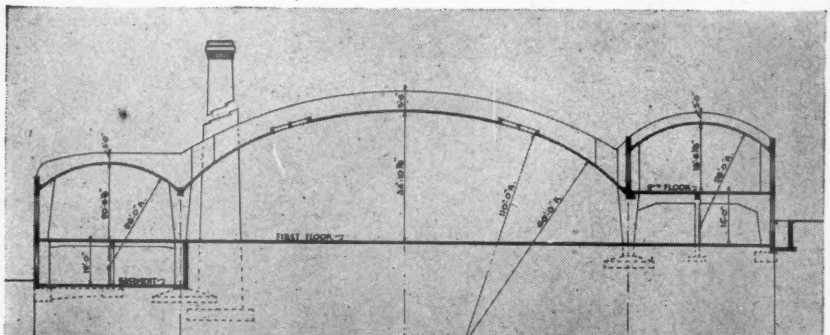
General Contractor:
Corbetta Construction Co., New York

WHEN your customers ask for 'Incor' concrete, you may be sure they have a definite purpose in mind . . . they've planned the job in terms of time, form and overhead savings assured by the use of America's FIRST high early strength portland cement.

In Repair Shop for New York City's Fire Department, covering two city blocks, barrel-arch structures were concreted with 'Incor' . . . elsewhere, Lone Star Cement was used. 'Incor' saved time-loss waiting for concrete to harden . . . even in cool weather, safe stripping strengths were obtained within 48 hours . . . result, maximum speed at minimum cost.

Job performance like this explains why leading Ready Mix Operators make 'Incor'* concrete available at all times, as part of their good service. 'Incor' economies broaden the market for concrete and that means more business for you.

*Reg. U. S. Pat. Off.



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1947 Edition CONCRETE INDUSTRIES YEARBOOK

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Yes, the big, new, completely rewritten 1947 Edition of the CONCRETE INDUSTRIES YEARBOOK—famous, up-to-the-minute encyclopedia hanubook of the concrete industries—is now ready for immediate delivery.

Its 100 pages are profusely illustrated and literally filled with all kinds of down-to-earth, ready-to-use, practical facts, data, methods, procedures, suggestions, and ideas —actually a concise combination of the "know how" of the keenest brains in all phases of the concrete industries.

In simple, explicit, easy-to-understand language the 1947 Edition of the CONCRETE INDUSTRIES YEARBOOK will tell you—how to step-up production, how to lower costs, how to improve quality, how to increase profits, how to lay-out equipment for most efficient operation, how to solve tough production problems—and a host of similar, valuable facts. In addition, it will put at your finger tips—illustrations and descriptions of all the important types and makes of equipment.

Regardless of whether you've been in the concrete business for 30 years . . . or . . . plan to enter it tomorrow—it will certainly pay you and every key man in your organization to own a copy of the 1947 Edition of the CONCRETE INDUSTRIES YEARBOOK. Advance orders already indicate that the big, new, 1947 Edition will be sold out in a hurry.

Remember—there are only a limited number of copies. Better order right now and avoid disappointment. Price — only $1.00 a copy.

NEWS OF CONCRETE MANUFACTURERS

Besser Mfg. Company Offers Series of Ads To Concrete Concerns

A newspaper mat service for concrete products manufacturers using Besser Vibrapacs has been inaugurated by the Besser Manufacturing Co., Alpena, Mich., U.S.A. This series of twenty-one

No. NP-6

One of the 21 free ads.

ads, 27 column inches each, is available free in mat form. The Besser advertising department will send the mats direct to the advertising manager of the local newspaper, where the operator's signature will be set at the bottom of the ad. Local papers will be glad to aid manufacturers in planning a consistent schedule of advertising, and will generally relieve the advertiser of all detail work once a definite amount of space is contracted for in a specified time.

Also available from the Besser Company are copies of a 24 page booklet—"This Business of Building a New Home" —which is similar in text, with certain additions, to the series of newspaper ads. The producer's name may be printed on the back cover of the booklet.

Concrete Association Holds Meeting in Portland, Ore.

More than 100 Pacific Northwest manufacturers of concrete pipe and blocks were represented in Portland, Ore., at the semi-annual meeting of the Associated Concrete Products Manufacturers, Inc.

F. R. Zaugg, president of the association, presided over the business session. After the banquet the group inspected local concrete block plants and the Tuerck MacKenzie pipe manufacturing plant.

Harold Geist Named Manager of Cleveland Block Concern

Harold Geist has been appointed general manager of The Geist Coal & Supply Company, Cleveland, O., it was announced today by President Herbert F. Geist. The new general manager has been with the company since 1942.

The Geist company has been located on Cleveland's West Side for over 40 years, engaged in the manufacture of concrete blocks and dealing in building materials and coal. During the past five years the company has achieved national recognition for having one of the most progressive block plants in the industry, as well as being among the top producers of this basic building material. The firm is still among the very few producers using a trade mark, "Geistone," on their blocks as an assurance of quality to the customer.

Harold Geist

. Mr. Geist states that the company has long since discontinued the manufacture of the old-fashioned heavyweight concrete blocks which he calls the "1910 model," in favor of the lightweight, insulating, nailable, modern streamlined block. Making a wide range of sizes and shapes in their blocks, the company is finding an ever-increasing demand for their "all Geistone" home, which saves materially on lathing and plastering costs.

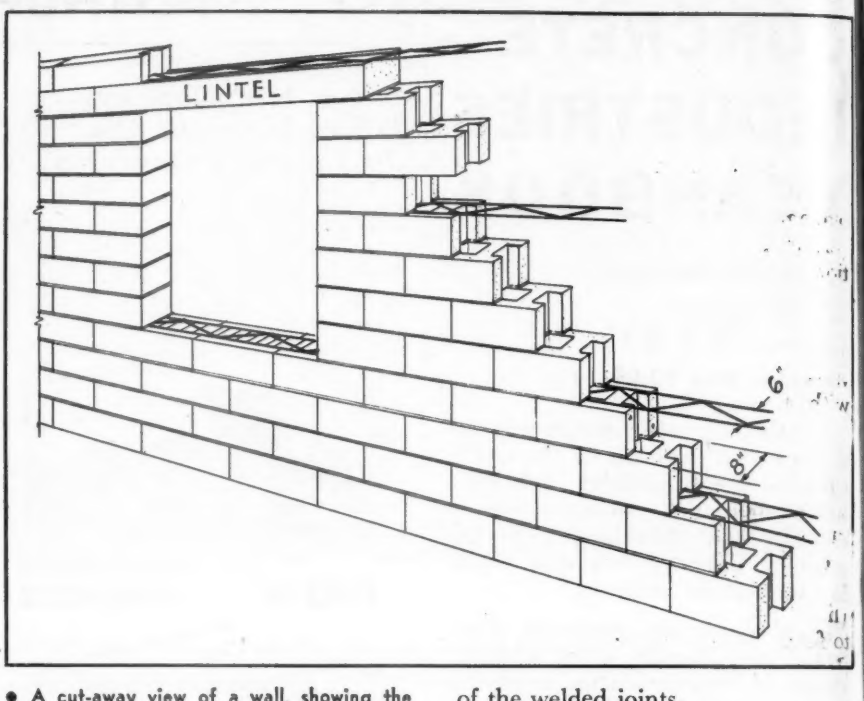
UNIQUE SYSTEM OF STEEL REINFORCING ORIGINATED BY IOWA BLOCK PRODUCER

another ON THE SPOT report

SEVERAL years ago Harold L. Spaight, owner of the Cedar Rapids Block Company, Cedar Rapids, Iowa, began experimenting with a unique type of trussed steel reinforcing for use in concrete masonry walls. The idea was actually conceived while Mr. Spaight was in a Cedar Rapids hospital recovering from an injury. He was deeply concerned at the time about a residential construction job for which his company's blocks had been specified. The buyer's wife had a wide reputation for fault-finding, and from his horizontal position in a hospital bed Mr. Spaight glumly anticipated the unholy row that would break loose when the first minute crack was found in the new masonry walls.

Steel reinforcing was one of the preventatives that Spaight considered. He reasoned that if monolithic concrete, with all its close controls, required reinforcing, why wasn't it equally desirable in walls built of concrete masonry units, involving many variables and relatively few controls? From experience, however, he knew that ordinary bent rods laid in the mortar joints of a masonry wall have a tendency to suspend the blocks, resulting in poor joints, interference with efficient laying and other problems.

To solve his immediate problems, Mr. Spaight sketched out some simple welded trusses, using ¼-in. rods, to be placed in the walls at doors, windows, and other locations where cracks might occur. The results were encouraging, and similar installations were made using a variety of truss forms and rod sizes.



• A cut-away view of a wall, showing the new steel reinforcing member which adds lateral strength to masonry walls and prevents cracks.

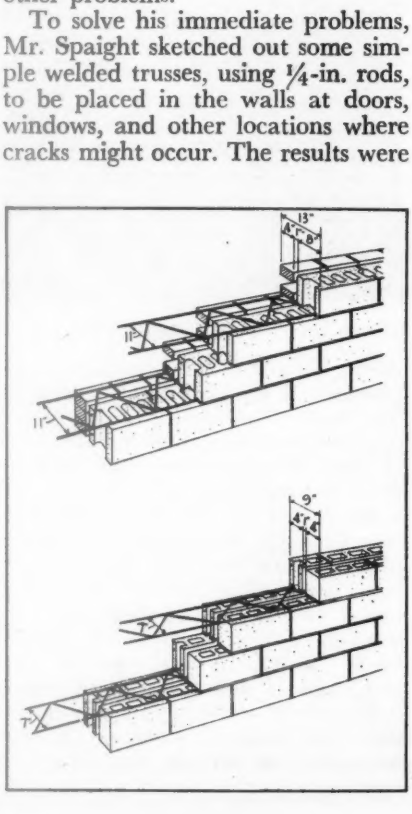
Out of these experiments came Dur-O-Wal, a patented masonry wall reinforcing which Mr. Spaight now manufactures and sells as a separate enterprise. It is made in 10-ft. lengths for wall thicknesses of 4, 6, 8, 10, 12 and 13 inches. It can be used in all types of walls—concrete block, brick, tile and face brick with back-up block—and for double-wall construction of any thickness.

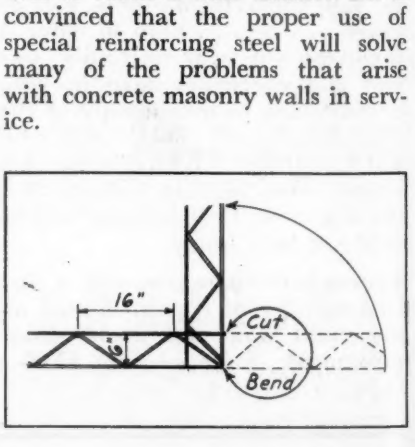
As the illustrations show, the lattice rods connecting the outer rods of Dur-O-Wal are electrically welded on 16-in. centers, creating a mortar lock or tie at each weld when the unit is laid in a wall. The truss form not only ties the two lateral rods together, but gives considerable lateral strength to the member. The reinforcement of a corner is accomplished by cutting one side rod and bending the opposite member at one of the welded joints.

Dur-O-Wall is recommended by the manufacturer for use wherever concentrated stresses are anticipated, particularly under and above all openings, at corners and in long expanses of wall. The price is said to be low enough to permit its use in any concrete masonry construction.

The Cedar Rapids Block Company is producing about 5,000 standard masonry units per day on a Besser Vibrapac, with production about equally divided between Waylite and sand-and-gravel units. Dry heat and live steam are used in the curing process to obtain temperatures as high as 180 degrees F.

Mr. Spaight, who has been in the block business for more than 15 years, has made preparations for increasing the production of Dur-O-Wal to reach a wide market. He is convinced that the proper use of special reinforcing steel will solve many of the problems that arise with concrete masonry walls in service.





• Left: In the wall upper section the reinforcing is used to tie face brick to back-up block. It may also be used for reinforcing any double wall construction of any wall thickness. The lower section shows how the reinforcing is used in double wall construction, to form an inch of insulating dead-air space.

• Right: Corner members are made by cutting the bar on one side and drawing it around.

Fly Ash Teams up with Portland Cement To Make Better Concrete

By WILLIAM M. AVERY

CONCRETE men are showing increased interest these days in a material called fly ash which is a by-product residue formed in the combustion of powdered coal at high temperatures. Used as a replacement for portland cement (either by intergrinding or by addition at the mixer), fly ash imparts some highly desirable characteristics to concrete, affecting it in some respects very much as chromium and vanadium effect steel when alloyed with it.

Fly ash is one of a number of materials which exhibit what is called puzzolanic activity when used in combination with portland cement. Puzzolanic activity is the chemical property which enables a material to combine with calcium hydroxide (lime) in the presence of moisture to form stable, insoluble compounds. Pozzuolana, used in the aqueducts of ancient Rome, was a mortar made of lime mixed with the dust of volcanic tuff found near the city of Pozzuoli. Roman structures owe much of their astonishing durability to the excellent hydraulic cements which were produced from volcanic ash. These ancient mortars show virtually no indication of the destructive action of efflorescence, which in modern concrete is caused by the liberation of lime during hydration, and the subsequent leaching action of water. Incrustations of lime carbonate an inch or more in thickness are frequently found on concrete which has been subjected to the action of percolating water.

Modern cement makers have attempted, with some success, to solve the problem of efflorescence by developing portland-puzzolan cements, composed of a mixture of standard portland cement and certain siliceous materials such as pumicite, diatomaceous earths and shales. As lime is liberated during the process of hydration, these siliceous materials combine with it to form various stable, insoluble compounds, such as monocalcium silicate and/or monocalcium aluminate. In addition to preventing the release of free lime, this action results in a long-continued gain in both the strength and impermeability of the concrete, in improved workability and in less segregation of the aggregate. Such materials are interground with the portland-cement clinker, or added to the cement in a finely divided state either in a blending plant or at the mixer. Regardless of the method of introduction employed, the actual replacement of portland cement seems to average about 25 percent.

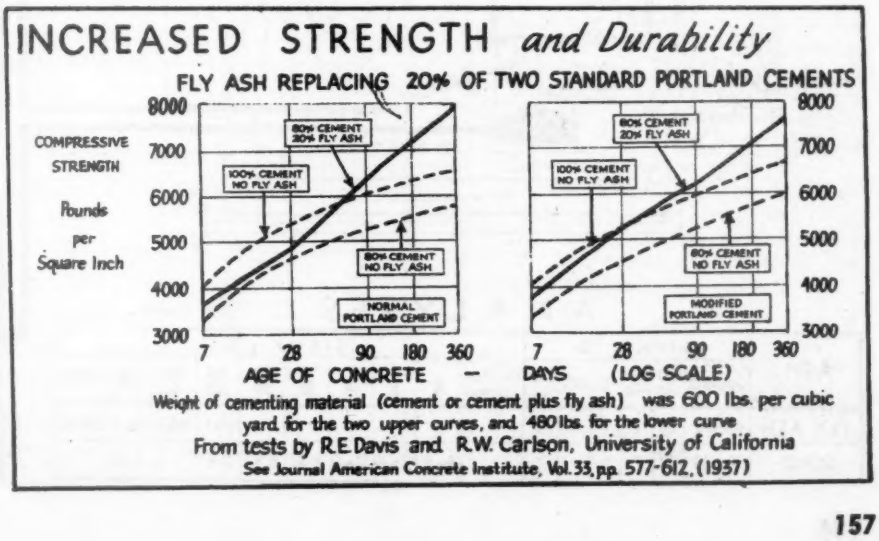
As is frequently the case, the advantages gained with portland cements containing natural puzzolanic materials are offset to some extent by certain undesirable characteristics. There is usually some loss in early strength, although at later ages the strength may exceed that of regular portland cement. Many cements of this type show more shrinkage in drying than standard cements, and most of them seem to require long-continued presence of water in order to develop satisfactory strength.

Fly ash was originally experimented with in the hope of eliminating some of these disadvantages. It seemed to be a rather promising possibility because the conditions under which it is produced so closely approximate those under which volcanic ash is formed, and it had additionally the advantage of being both cheap and readily available. Fly ash is formed as powdered coal passes through the zone of high temperature in a boiler. As the carbon is burned off a residue, consisting of fused particles, remains in suspension, and is carried to a comparatively low-temperature zone where the particles fuse to form fly ash. To prevent the ash from constituting a dust nuisance, it is usually collected by Cottrell precipitators just before the flue gas enters the stack.

Although there are minor differences in the chemical composition of fly ashes derived from various coals, the principal compounds are silica, alumina, iron oxide and lime. In all cases SiO_2 predominates in the ratio of more than 2 to 1 over the other compounds present. There is always some carbon present, but efficient combustion in a properly designed and operated boiler plant automatically holds carbon content to very low levels.

The puzzolanic characteristic of fly ash are derived from its chemical composition and from the extremely rapid cooling which takes place as it passes through the boiler. But it is the extreme fineness of the material which makes it one of the most active puzzolanic materials known. It may have a specific surface of 3,700 to 4,100 sq. cm. per gram, or more than twice that of standard portland cement, which usually falls in the range of 1,600 to 1,800 sq. cm. per gram.

Particles of fly ash are usually spherical in shape and have smooth glassy surfaces as a result of being fused in suspension at temperatures far above their melting point. The fused surfaces of the material result in very low absorption, and make it possible to place workable concrete (containing fly ash) with less water than when portland cement is used alone. This seems to be one of the most valuable properties of fly ash, for one of the more serious objections to most natural puzzolanic materials is their tendency to increase the water-cement ratio required for a given workability. Chemically fly



• Graph showing results of replacing 20 percent of Portland cement with fly ash.

Weight of cementing material (cement or cement plus fly ash) was 600 lbs. per cubic yard for the two upper curves, and 480 lbs. for the lower curve

From tests by R.E. Davis and R.W. Carlson, University of California

See Journal American Concrete Institute, Vol. 33, pp. 577-612, (1937)

ash acts in the same manner as other puzzolanic materials, by combining with the free lime of hydration to form addition insoluble cementing material.

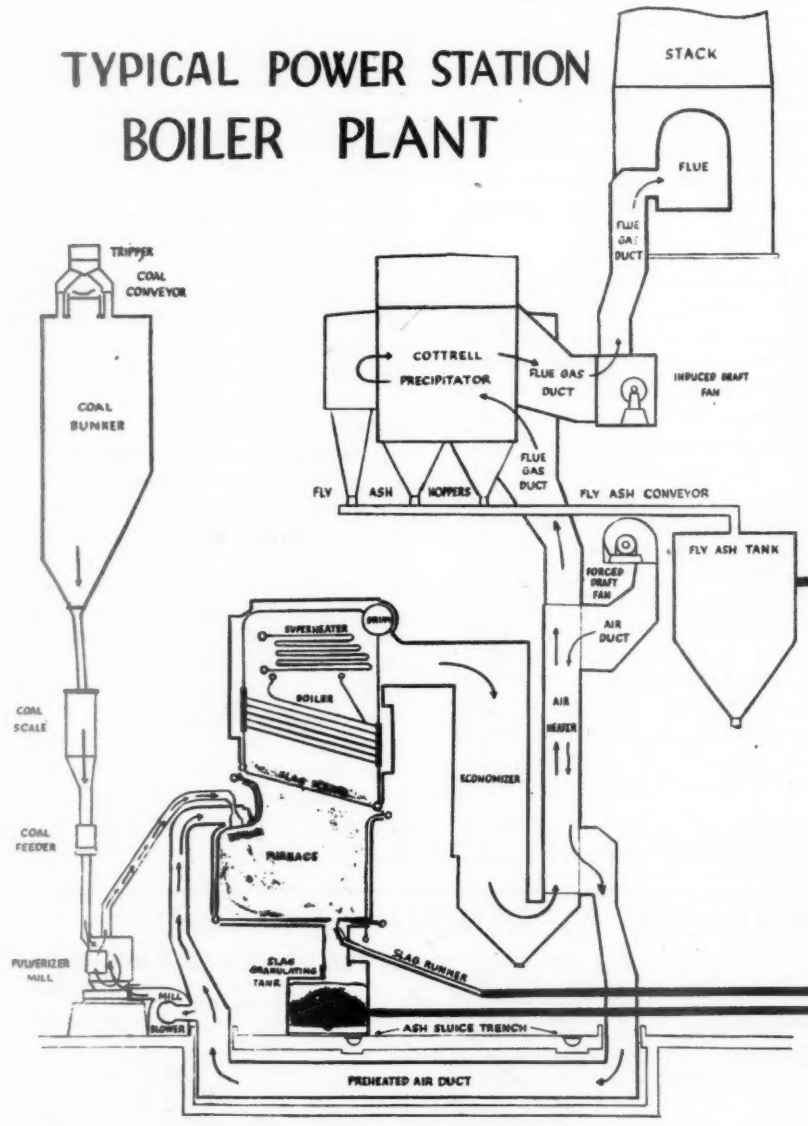
Test data accumulated over a period of 15 years show that fly ash may replace up to 20 or 30 percent (by weight) of portland cement without substantially affecting the 28-day strength of the concrete as compared with straight portland cement concrete (graph, p. 157). With steam curing satisfactory tests are achieved in 4 or 5 days, with no apparent retarding of strength. At later ages there is a considerable increase in strength as the fly ash combines with free lime to form monocalcium silicate. In some cases comparative tests on concrete pipe have shown remarkably higher strengths for fly ash even at 28 days.

Comparative tests of plain concrete and concrete containing fly ash show greatly reduced permeability as measured by cumulative total water forced into specimens under a 60-ft. head (graph, p. 159). The difference in permeability is most striking, however, up to the age of 3 months. At 6 months both plain concrete and fly ash concrete specimens show very low permeabilities.

As the properties and advantages of fly ash become better known it is being specified more and more on monolithic concrete construction for industrial purposes. It has been shipped to distant points, even when the freight cost has amounted to several times as much as the actual cost of the material. In the concrete products industries fly ash is being used as a replacement for cement in masonry units, pipe*, burial vaults, conduits, silo staves *et cetera*. Users in the products field report the fol-

*See *"Fly Ash Successfully Employed by Two Midwestern Producers,"* PIT AND QUARRY, December, 1946, pages 135-138.

• A cross-section of a typical power station boiler plant, showing how fly ash is recovered from the flue gas. Other by-products of the combustion of powdered coal are molten slag and granulated slag.



FLY ASH

PRESENT USES

Puzzolanic Material with Portland Cement in Mortars and Concretes

Puzzolanic Material in Asbestos Cement Products

Asphalt Filler

Remelting into Slag

POSSIBLE USES

Ceramic Products

Artificial Stone

Filler Material in Plastics, Rubber Paint, Prepared Plasters & Mortars

MOLTEN SLAG

POSSIBLE USES

Blocks, Paving Stones, Railroad Ballast

Concrete Aggregate

Mineral (Slag) Wool

Ferro-Silicon & Alumina (By Electro-thermal Reduction)

GRANULATED SLAG

PRESENT USE

Combined Iron Ore & Flux

POSSIBLE USES

Fine Aggregate in Concrete (Crushed and Screened)

Puzzolanic Material (Pulverized)

Roofing Granules

ANALYSES

ASH	CHEMICAL - %							SIEVE - %									
	SiO_2	Al_2O_3	Fe_2O_3 / FeO	CaO / MgO	C	SO_3	Alkalies	Thru Mesh On Mesh	4	4/8	8/16	16/30	30/50	50/100	100/200	200/325	325
FLY ASH	45	19	20	7	1	3	4		-	-	-	-	-	½ to 1	1 to 2	1 to 3	90 to 95
SLAG	38	16	36	7	-	-	2		4 to 8	12 to 20	36 to 42	24-32	6-10	2-4	½ to 1½		

lowing advantages: increased workability and strength, improved surface texture, better waterproofing qualities and reduced cracking and breakage in handling.

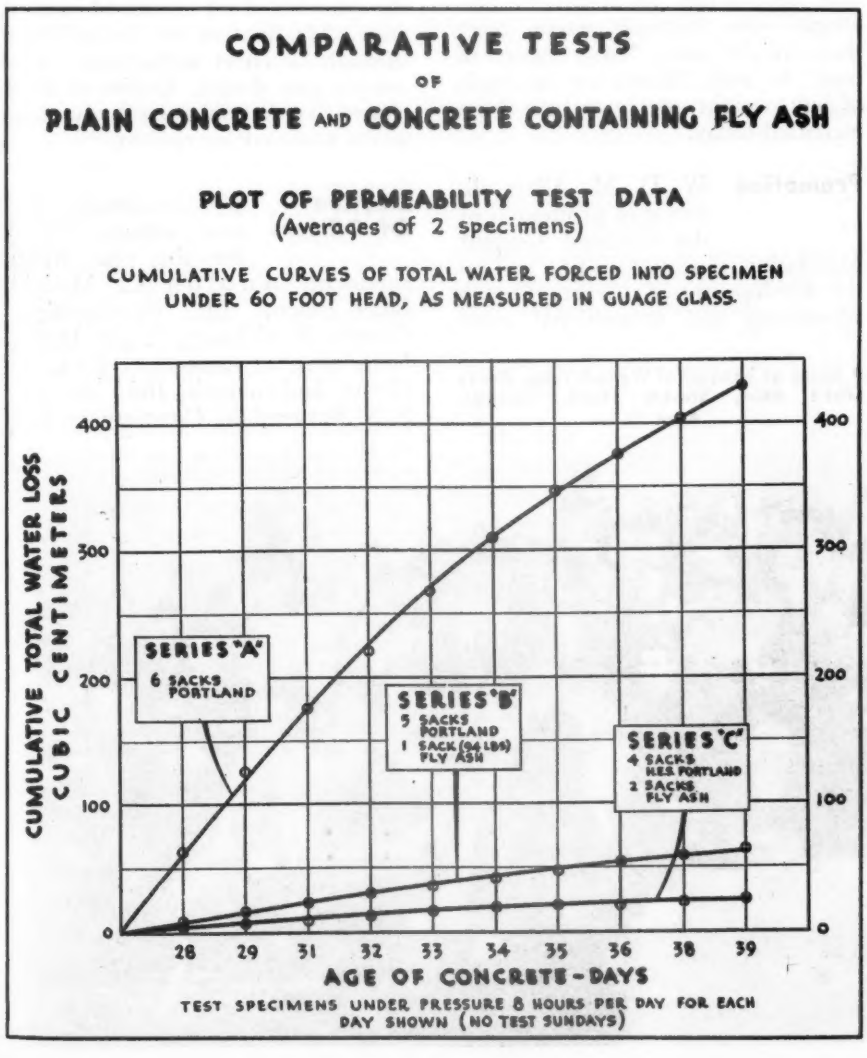
Fly ash is not an expensive material. For the user's convenience in proportioning, it is available in 100-lb. bags or it may be purchased in bulk carloads. Fortunately, tests show that there is no particular advantage in interginding fly ash with portland cement, and there are even some indications that superior results are obtained when the addition is made at the mixer. Uniformity of fly ash can be controlled by the supplier within very narrow limits by the use of a Fuller-Kinyon dry blending system to mix each day's production with material in storage.

Since the free carbon content of fly ash is entirely inert and has no cementing value, it should be kept as low as possible. Excessive carbon is also objectionable because it tends to increase the water-cement ratio of the concrete, nullifying the beneficial effect of the fly ash itself in reducing water requirement. When the carbon content of fly ash is held within the proper limits, mixing water may be reduced by as much as 3 gallons per cubic yard with no change in slump, and with an increase in workability of the concrete.

It would be presumptuous and probably pointless to attempt here to appraise the future of fly ash as a replacement for portland cement in concrete work. The use in any event will have the last word. Because the concrete industries are progressive and unfettered by hidebound tradition, we feel sure that fly ash will have a wide opportunity to demonstrate its advantages. To date the people interested in its production have put forth very little effort to promote its use, preferring to allow experience, test data and performance records to argue the merits of the material. As a result of this policy, comparatively few concrete men know much about fly ash, although it has been in use on a small scale for more than 15 years.

On the face of it, fly ash might seem to be competitive with portland cement. This point of view is certainly encouraged to some extent by the use of the term "replacement" in connection with it. In the long run, however, it seems to us that materials such as fly ash complement rather than replace portland cement. Since their use is wholly predicated upon improvements in the quality and performance of concrete, and/or reductions in the cost of concrete, their long-term effect, it seems to us, can only be to increase the use of portland cement.

• Graph showing results of comparative permeability tests of plain concrete and concrete containing fly ash.


COMPARATIVE TESTS
OF
PLAIN CONCRETE AND CONCRETE CONTAINING FLY ASH
PLOT OF PERMEABILITY TEST DATA
(Averages of 2 specimens)
CUMULATIVE CURVES OF TOTAL WATER FORCED INTO SPECIMEN UNDER 60 FOOT HEAD, AS MEASURED IN GUAGE GLASS.
CUMULATIVE TOTAL WATER LOSS CUBIC CENTIMETERS
0
100
200
300
400
SERIES "A" 6 SACKS PORTLAND
SERIES "B" 5 SACKS PORTLAND 1 SACK (94 LBS) FLY ASH
SERIES "C" 4 SACKS NES. PORTLAND 2 SACKS FLY ASH
28 29 31 32 33 34 35 36 38 39
AGE OF CONCRETE - DAYS
TEST SPECIMENS UNDER PRESSURE 8 HOURS PER DAY FOR EACH DAY SHOWN (NO TEST SUNDAYS)

Upson and Associates Publish Industry Report

Maxwell M. Upson, board chairman of the Raymond Concrete Pile Company of New York, N. Y., and a past president of the American Concrete Institute, was one of 16 business executives and economists appointed six years ago to the Economics Principles Commission by the National Association of Manufacturers to study the historical background of the American economy.

In the 1,100-page report of the group the opinion was expressed that the American individual enterprise system can be preserved, despite the apparent drift toward collectivism and dictatorship.

Diamond Cement Company Plans $750,000 Expansion

Anticipating an increased demand for their products, the Diamond Portland Cement Company of Middlebranch, O. is planning a $750,000 plant expansion program. According to Richard D. Raff, president of the company, $350,000 of the money will be spent for new equipment and the remainder for construction.

The money is to be raised through an issue of 24,000 additional common stock shares and a $450,000 term loan.

Partners Build Their Own Concrete Block Plant

Manufacture of concrete blocks has been started in a new building erected by three partners, R. M. Wood, Sr., R. M. Wood, Jr., and Frank Doran, in Pontiac, Mich. The owners estimate that they will be able to turn out 3,000 blocks in an eight-hour shift.

The plant and its equipment, including four low-pressure steam curing rooms and the block machine, are valued at $75,000. All constructon work on the building was done by the owners.

Damage estimated at $10,000 resulted from a fire which broke out in the plant of the Bluffton (Ind.) Ready Mix Company several weeks ago. The flames were confined to the interior of the structure and damaged valuable equipment.

Wabash Valley R.M. Association Holds Annual Meeting in Chicago

another ON THE SPOT report

THE annual convention of the Wabash Valley Ready-Mixed Concrete Association was held at the Stevens Hotel, Chicago, Ill., April 10-11, 1947. More than 150 producers and guests registered for the two-day convention and the short courses on ready-mixed concrete. R. E. Shouweiler, outgoing president, welcomed the members and introduced the speakers.

Labor Legislation Vincent P. Ahearn, executive secretary of the National Sand & Gravel and Ready-Mixed Concrete Associations, warned the audience of the inherent dangers of sections of the labor legislation pending before Congress. Inclusion of the compulsory arbitration section in the bill, Mr. Ahearn said, "constitutes the first step toward totalitarianism." He went on to say that this section, if passed, will not only curb despotic unionism, but will effectively socialize management.

Interpretations of the Wage and Hour Law have placed an added burden upon those companies who pay an annual bonus or who allow their employees to participate in some form of profit sharing. In some cases, Mr. Ahearn said, where a bonus is paid, the lump payment must be expressed as an increment in earnings of so much per hour. In the event that the employee has put in overtime during the year, a special compensation has to be paid for the overtime at his bonus-increased hourly rate.

Light Weight Aggregate Paul M. Woodworth, director of research and development of the Waylite Company, talked on the potential use and marketability of light-weight aggregates for the ready mixed concrete industry. He pointed out the ever increasing acceptability of light-weight concrete for use in multi-story structures. Mr. Woodworth was particularly enthusiastic over potentialities of prefabricated concrete acoustical panels.

Shipping Conditions For 1947 Following Mr. Woodworth on the program, Z. G. Hopkins, special representative of the Western Railway Executives, explained that, as light-weight aggregate approached the ideal—without weight—the railroads would alter their freight rates. "As a matter of fact," he said, "Rates for car loads of light-weight aggregate have been increased today."

Promotion W. D. M. Allan, director of promotion of the Portland Cement Association, repeated his fine talk on the development of markets through advertising and promotional campaigns which he gave at the Los Angeles convention of the National Ready Mixed Concrete Assn. He reiterated the offer made by P.C.A. to distribute, without charge, advertising matrix forms suitable for newspaper promotion.

Short Course On Friday, April 11, the short course on ready mixed concrete was presented. This course, successfully tried before, is the refinement of hours of lecture instituted several years ago at Purdue University.

Professor R. E. Mills of Purdue, lectured on the fundamental concepts involved in designing concrete mixes. The talk was highly technical, although well within the scope of the audience. Professor Mills believes that the best mix design is more easily and more correctly derived from a surface area curve.

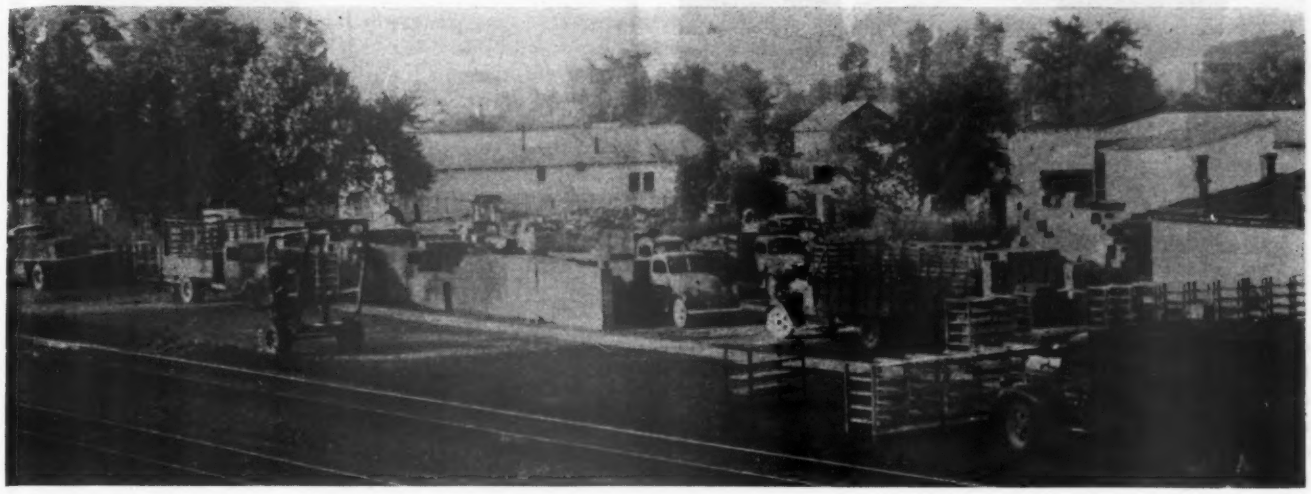
Stanton Walker, director of engineering for the National Sand and Gravel and Ready Mixed Concrete Assns., then talked abut the entrainment of air in concrete. He also demonstrated two types of instruments used for the measurement of the quantity of air entrained in concrete. Mr. Walker led the audience through a chart calculation of a sample mix design. Copies of these charts can be obtained by writing to the national association.

Election Of Officers By unanimous vote new officers elected for the year were: president, Adolph C. Modahl, Bloomington, Ill; vice-president, Charles P. O'Leary, Terre Haute, Ind.; secretary-treasurer, Ernest Horne, Indianapolis, Ind.; director, F. N. Bunzendahl, Connersville, Ind.

• Scene at banquet of Wabash Valley Ready Mixed Assn., Stevens Hotel, Chicago, April 10.

Daily Invasion of Block Buyers Strips Racks of 5,000 Units

By WILLIAM M. AVERY



another ON THE SPOT report

THE huge farm demand for concrete products, in combination with the proximity of its plant to the Indianapolis stock yards, has for the past four years made the Schuster Coal Company's storage yard resemble Old Settler's Day at the County Fair. Farm trucks, unloaded at the stockyards in the early morning, converge upon the Schuster plant (some two miles distant) to load concrete masonry units for the return trip. In spite of the general confusion and at times quite serious traffic congestion which result (see illustration above), by noon each day the previous day's output has invariably disappeared from the storage yard.

This condition would be at least mildly surprising even if the Schuster company had actively promoted farm use of its products. In this instance, however, the farmers have taken the initiative, and far from encouraging raids of the kind shown in the illustration at the top of this page, the company has had arbitrarily to restrict farm sales to about half the output of 5,000 units per day. Only by such means was it possible to continue supplying dealers and contractors who had bought from the company since its inception.

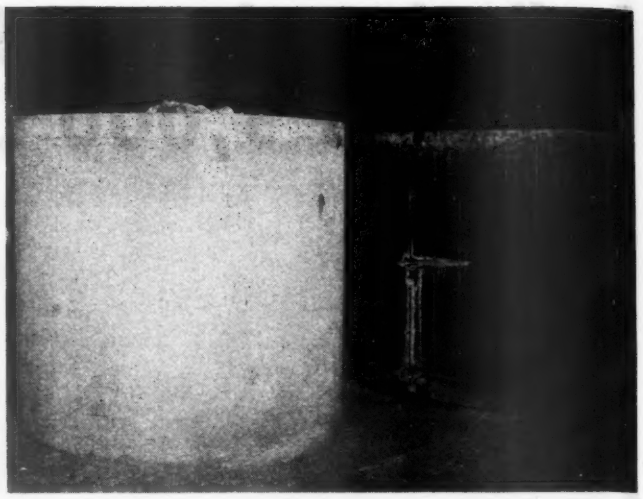
• A general view of the block storage yard of the Schuster Coal Company of Indianapolis. After unloading at the nearby stockyards, farm trucks pull into the Schuster yard to load block for the return trip. The yard is usually cleaned out by noon each day.

The high proportion of farm sales has had some definite advantages, however, and the Schuster company hopes its farm following will remain a permanent fixture. For one thing, the concern couldn't possibly have delivered its own output during most of the war period, when trucks and drivers were unobtainable and it was almost impossible to maintain existing equipment. It was also extremely difficult during the war years to hire adequate crews for stacking units on the yard, even though rates up to $1.30 per hour were offered. Farm purchasers solved that problem, too, by unloading units directly from the curing racks onto their trucks. Bookkeeping and collecting costs have gone down appreciably with the increase in rural sales, for farmers without exception prefer to operate on a cash basis.

Although the plant is equipped to produce a complete line of concrete masonry units, the tremendous demand for 8- by 8- by 16's has temporarily limited output to this size. Sand and gravel for the operations are produced at a company-

• Below, left: The company is producing 5,000 units per day on this machine. About half of the output is sold to farmers.

• Right: The discharge gate on the 40-cu.-ft. mixer is operated with an air ram.



• Above, left: Gasoline-powered hydraulic lift trucks (called "mules") were designed and built at the plant.

• Above, right: Reinforced concrete septic tanks, in 300- and 500-gallon sizes, are made with two steel molds.

owned pit located about two miles from the block plant. Aggregate production, which began in June, 1945, is at present just adequate for the company's own needs, but eventually materials will be offered for general sale.

The output of 5,000 8-inch units per day is accomplished with a Besser 40-cu.-ft. mixer and a Vibrapac machine. With a yield of 27 blocks per sack of cement, and a batch consisting of 2/3 sand and 1/3 pea gravel, the units attain an average strength of 1,600 to 1,700 p.s.i. at 28 days. All the materials are batched by weight and a Neptune dial meter is used to measure the mixing water.

Materials at the plant are stored in three 20-cu.-yd. elevated bins — one for cement and one each for sand and pea gravel. Although only bagged cement is purchased, the bags are opened on the ground floor and dumped into a hopper at the base of a bucket elevator which feeds the cement bin. Sufficient sand and gravel—between 5,000 and 10,000 cubic yards—are stored at the gravel pit to run the block plant through the winter months. Company-owned trucks make the two-mile haul from the pit. Output at present is running around 200 cubic yards per day.

The block plant is extraordinarily efficient from the standpoint of manpower. The crew comprises three men—a machine operator, a pallet man and a lift-truck operator. The three elevators with which materials are fed to the weigh boxes are equipped with automatic cut-off switches, and the discharge gate on the mixer is operated with an air ram. With these mechanical aids it has been found entirely feasible to operate without a mixer man. In addition to two hydraulic lift trucks designed and built at the plant, the company operates a recently purchased highlift truck. Curing is done in six steam chambers which have a capacity of 1,000 units each.

The Schuster company operates two molds for producing reinforced concrete septic tanks in 300- and 500-gallon capacities. Concrete lintels are also produced. The present plant was built in 1941, replacing an older plant with which the company started block production back in 1922.

J. H. Kerrick, who was formerly fuel engineer of the Philadelphia and Reading Coal and Iron Co., has become manager of the Berks Building Block Corporation at Reading, Pa.

William I. Reid, a manufacturer of concrete burial vaults in Hopewell, N. J., died at his home in that city on March 30 at the age of 79 years.

• Right: Bagged cement is dumped into a hopper, elevated to a weigh box and then fed by a screw conveyor to the mixer.

• Approximately 180,000 tons of reinforced concrete pipe—enough to construct 40 miles of the San Diego aqueduct—are currently being hauled to the job by Fruehauf trailers. The accompanying illustration shows eight of the 16-foot-long sections. Diameters of the pipe are 48, 54 and 62 inches, and weights range from 9 to 17 tons per section. The trailers belong to a fleet of 200 Fruehaufs owned and operated by the United Concrete Pipe Corporation. This firm is under contract for the construction of a section of the aqueduct between San Jacinto and San Diego. (See Pit and Quarry, March, 1947, page 146.)

Mammoth Precast Pipe Sections Made For Los Angeles Submarine Sewer

another ON THE SPOT report

If it comes from Hollywood, it's bound to be stupendous . . . colossal! From anywhere within the borders of California it's usually the biggest, the best. So with the precast concrete pipe sections described in this article by Pit and Quarry's Pacific Coast editor. One hundred feet long and 14 feet in outside diameter, these concrete pipe sections are undoubtedly the largest ever produced. They will be anchored to the ocean floor to form Los Angeles' new mile-long submarine outfall sewer.—THE EDITOR.

REINFORCED concrete pipe sections 100 feet long, with an inside diameter of 12 ft. and an outside diameter of 14 ft., are in production this spring for a sewer project in California. Believed to be the largest pipe sections ever to be precast, the units will be laid on the floor of the Pacific Ocean as part of the mile-long Hyperion Submarine Outfall Sewer of the city of Los Angeles.

The pipe are being produced by the Guy F. Atkinson Co. at a special plant set up on Terminal Island in Long Beach. After curing, the sections will be launched on pontoons and towed by seagoing tugs to Hyperion, in Santa Monica Bay, 30 miles by water from Terminal Island.

A total of 32 of the 100-ft. sections will be turned out. The first section was poured on February 6, 1947, and

By HARRY F. UTLEY

it required 13 hours before the huge form was filled and compacted. The second was poured on February 28 in about half the time.

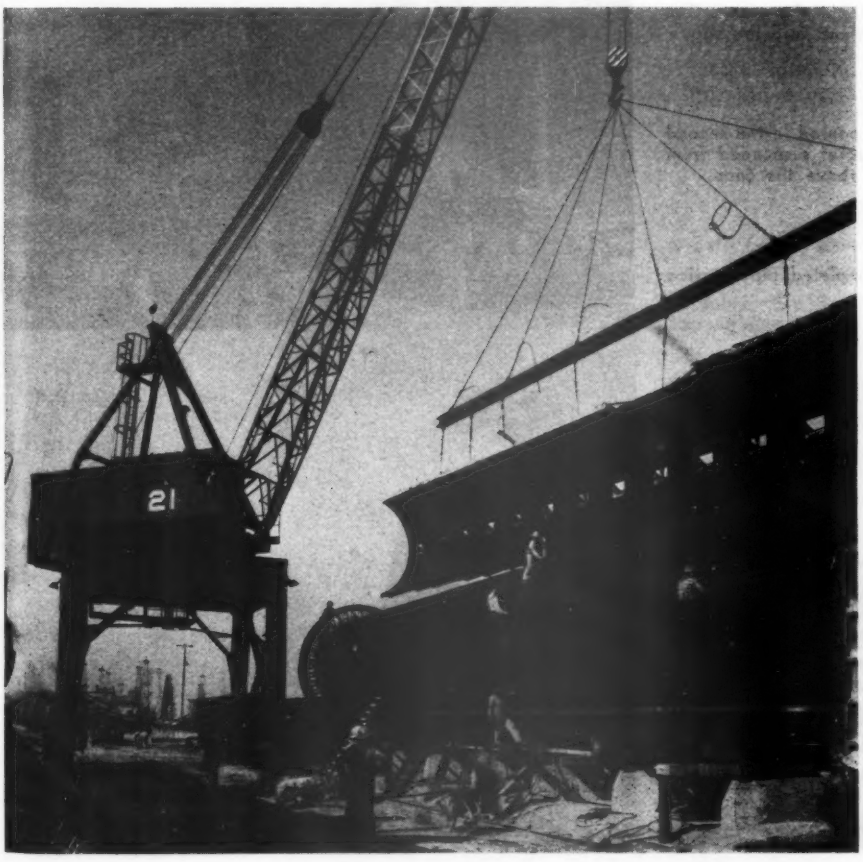
The steel forms used were designed and built by the Willamette Iron & Steel Co. (an Atkinson subsidiary) in Oregon and shipped to Long Beach. The Bethlehem-Pacific Coast Steel Corp. is furnishing and fabricating the reinforcing steel. Each completed cage weighs 45,340 lb. Outside rings on the bell ends are 17 ft. 4½ in. in diameter and are formed of 1¼-in. square bars. The main cage rings are ¾-in. round steel bars. Because of the unusual length of the longitudinal bars, they are transported at night under police escort by special trucks and trailers from the Bethlehem-Pacific Los Angeles plant.

The concrete is mixed in a crawler-mounted Ransome 34-E dual-drum heavy-duty mixer and carried aloft to the forms in a Gar-Bro 1½-cu.-yd. concrete bucket by a Colby shipyard type full-revolving gantry crane equipped with a 100-ft. boom. The crane is set up on rails in the center of the plant with the mixer in a convenient position on the runway for the crane to handle the concrete bucket. Foundations on either side of the crane runway permit work to progress on four sections simultaneously. Four stages of construction are represented: (1) assembly of the cage rings, (2) placing of the longitudinal bars, (3) placing the bell-end reinforcing rings, and (4) pouring the concrete into the cylindrical steel forms which enclose the completed cage.

To insure a dense, watertight concrete, a 1:2:3 mix is employed using a relatively small size of coarse aggregate. The maximum size used in the first two sections was 1 in. but consideration is being given to increasing this to 1½ in. The aggregates are blended and dry-batched at the Long Beach bunkers of Graham Bros. and delivered to the job in 5-compartment dump trucks. Type II Portland cement is used without admixture, the cement being added at a temporary plant setup at the job beneath which the batch trucks drive. The trucks dump directly into the charging scoop of the mixer. The concrete is designed for a 4-in. slump and for 3,000 lb. strength at 28 days.

The crane lifts the loaded buckets and the concrete is discharged directly into the form openings, or into a 2-compartment portable hopper on top of the forms, from which it is rehandled with buggies.

To insure uniform compaction and perfect bond between the concrete and the maze of reinforcing steel, specifications require thorough vibration, both externally and in-



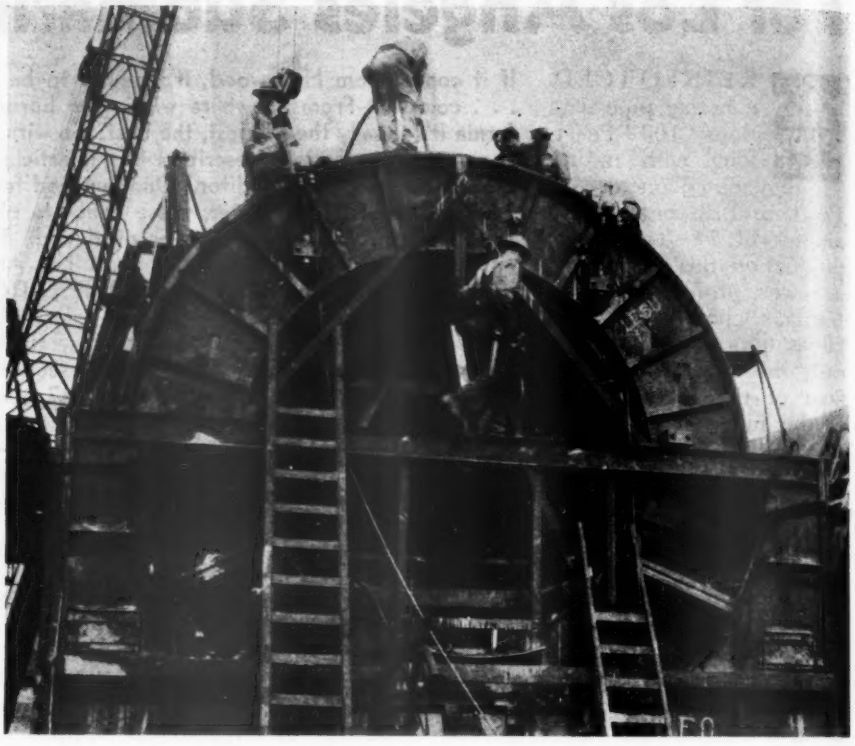
• A scene at the plant set up by the Guy F. Atkinson Company at Terminal Island, Long Beach, Calif. A gantry crane here assists in placing a part of the outside form section over the reinforcing cage. Note the ports in the form, through which the concrete will be poured.

ternally. At 80 points on the outside of each form, special brackets have been attached by welding to support the Viber electric-powered vibrators, while the same type of Viber units equipped with 12-ft. flexible shafts are used for internal vibration, the vibrator shafts being inserted into the pouring ports at numerous positions on the form. The vibrator units are high-speed (9,500 r.p.m.) low-amplitude vibrators similar to those specified for use externally on the forms in which the pipe sections were poured for the 71-mile San Diego Aqueduct (PIT AND QUARRY, March, 1947, p. 146), except that air power was used on the aqueduct project to drive the vibrator motors, while on the present job electric motors are employed.

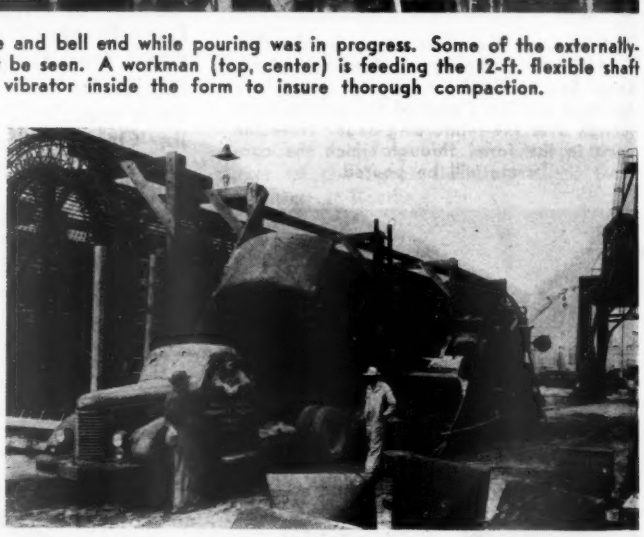
Each 100-ft. pipe section contains about 220 cu. yd. of concrete, equivalent to about 150 bucket-loads. After the forms are stripped, the section is coated inside and out with Hunt Process curing compound. Los Angeles city inspectors make 26 test cylinders from representative mixes as each section is poured. A few of these are broken at the age of 4 or 5 days and the remainder 15 days later and on up to 28 days.

Concrete towers have been built at the edge of Los Cerritos Channel from which the 100-ft. sections will be launched for towing to Santa Monica Bay. Each complete section weighs about 225 tons with its cradle. The concrete cradle, cast integrally with and at one end of each section, supports the spigot end of the next pipe section in the line.

(*Continued on page* 168)



• A view of the cradle and bell end while pouring was in progress. Some of the externally-mounted vibrators may be seen. A workman (top, center) is feeding the 12-ft. flexible shaft of another vibrator inside the form to insure thorough compaction.



• Right: A view of the mixer setup in relation to the crane. The batch truck is discharging dry concrete ingredients into the skip.

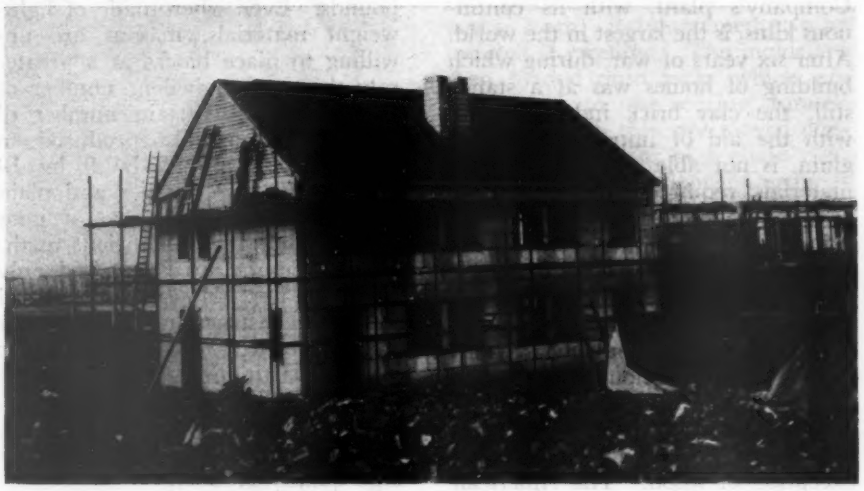
• Below, left: At this point concrete was being poured in the second section to be assembled. Note the concrete bucket suspended from the crane hook over the portable hopper above the form.

• Below, right: An offshore view, showing a completed pipe section in the foreground.

Precast Concrete Developments In Great Britain — A Survey

WITH the ending of the war and the election of the Socialist government in Britain, the building of homes for the people has assumed tremendous importance. It is necessary to make up for six years during which no houses were built, while great numbers were damaged or destroyed by enemy action. At present only what used to be called "working-class" homes are being built—that is, small five- or six-room houses. By decree of Aneurin Bevan, mercurial Welsh-born Minister of Health, the majority of these are to be built by local authorities (municipalities and so forth) either directly or through subcontractors, while only a limited number of licenses are to be issued to private-enterprise builders. Furthermore it is decreed that a large proportion of houses are to utilize "non-conventional" types of construction. These "non-conventional" type homes adhere as far as possible to the conventional layout and appearance—that is houses built on two floors and in pairs, with a party wall between them. These are known as semi-detached houses. Prices are strictly controlled and are about two-and-one-half times the prewar price. Current prices of prewar houses are considerably above this figure.

By ALFRED A. RYNER
International Corporation, Ltd.,
London, England



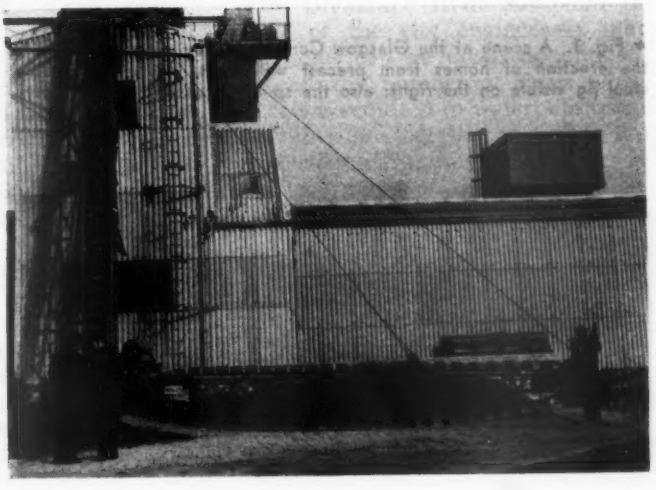
• Fig. 6. The "Orlit" house, showing concrete roof tiles being placed. The slabs of this house are finished in white Portland cement stucco.

The first houses built after the war were prefabricated temporary houses, with an expected life of ten years, which were built in considerable numbers on all kinds of suitable and unsuitable sites, but mostly on vacant areas cleared by Nazi bombing. Experience has shown that the cost of these is very high in proportion to their utility, while their completion took much longer than anticipated because of inadequate supplies of plumbing and other fittings. They are extremely small, and in most cases consist of a steel frame, clad with asbestos sheet and plaster board, with a roof of corrugated asbestos sheet. They stand on a concrete floor laid direct on the ground. They would, of course, hardly be adequate for American conditions, where the seasonal variations of temperature are very much greater.

Emphasis is now on permanent houses. In the past, a great many different types of construction have been used, ranging from the picturesque half-timbered house with its solid oak frame and thatched roof, to the natural-stone masonry

• Left, Fig. 1. Elevators and boom scraper at the Glasgow Corporation's precast concrete plant.

• Below, Fig. 2. The Winget 30-foot boom scraper moving the foamed slag at the Glasgow Corporation's plant. The operator is adjusting the height by means of a large wheel.



house and slate roof. Examples of all these are still plentiful, but since the beginning of the twentieth century the clay brick home has gradually eliminated all other types. Clay bricks are produced in enormous quantities, and the London Brick Company's plant, with its continuous kilns, is the largest in the world. After six years of war, during which building of homes was at a standstill, the clay brick industry, even with the aid of imports from Belgium, is not able to supply all the materials required. Encouragement is therefore being given to the development of all kinds of unconventional forms of construction, and many ingenious and even fantastic schemes are being tried. The aircraft industry is producing a half-million aluminum houses; homes are being built with steel frames, with concrete frames and from every kind of material, with the notable exception of wood. The American type of frame house has always been uncommon here, perhaps because of the lack of soft wood or because of the dampness of the climate; but now the postwar lumber shortage has caused the authorities to discourage every kind of wooden construction, and lumber is as hard to buy as sugar or butter.

Among all the different types of construction being developed, concrete takes a prominent place. In the past the concrete house has been condemned as a result of unsuccessful experiments carried out after World War I. Now necessity overrules conservatism and concrete construction sees its greatest opportunity; but the methods adopted differ greatly from those current in the U.S.A. The hollow, precast building block is hardly used at all, partly because of popular prejudice against its alleged dampness and "sweating," and also because of shortage of modern high-speed machinery for its production. Blocks are also unpopular with building workers. Since the British clay brick is larger than that used in the U.S., modular sizes of building blocks are correspondingly larger, the equivalent of an American 8- by 8- by 16-inch block being one measuring 9 by 9 by 18 inches and weighing about 54 pounds. Even when made of lightweight materials, masons are unwilling to place blocks at a greater rate than an equivalent number of clay bricks. A certain number of cinder blocks are also produced, to a nominal size of 9 by 9 by 18 inches, with two cavities and plain ends, but due to the use of poor quality cinder and inefficient methods of manufacture, they find only a limited use. However, nearly all types of construction utilize cinder slabs (known as breeze blocks) for interior partition walls. These are generally about 2½ inches thick, and as they bear no structural load, there is no insistence by users on a high quality product.

Both partition walls and inner faces of outside walls are generally finished with plaster, applied direct without furring.

A great deal of thought has been given to the design of special precast or prefabricated concrete units. Some designs involve a great variety of special interlocking concrete units from which every part of the structure may be built, while others prefer to use the largest and simplest possible units, for the erection of which powerful cranes are necessary.

In Glasgow, Scottish city of more than a million inhabitants, the Glasgow Corporation Housing Department has laid elaborate plans for the construction of concrete homes by several methods. Extensive use is being made of foamed slag aggregate, a by-product of the local steel industry, because of its lightness and insulating properties. A plant operated by the Housing Department itself produces precast wall units up to 10 feet high, 8 feet 8 inches wide and 6 inches thick. These units are cast with integral door and window apertures as required. They are produced in a building measuring 270 ft. by 170 ft., of steel construction, clad with corrugated asbestos sheet. Figures 1 and 2, show a part of the building in which are housed storage bins and mixing plant, fed by Winget elevators. Bulk cement is not at present available in Scotland, and the cement is delivered in 112-pound paper bags which are emptied into a hopper. From the hopper the elevator and screw conveyor deliver it to the overhead bin. Foamed slag is delivered in dump trucks and is fed to the elevator by a Winget patented boom scraper, which might be described as a "horizontal bucket-elevator," the buckets of which drag the material along the ground until it falls into the elevator hopper. The boom is 30 feet long and swings through an angle of 180 degrees. It can be raised or lowered by means of the large handwheel. The ground storage space made available in this way accommodates about 150 cubic yards of material which can be fed to the overhead bins at the rate of 75 cubic yards per hour. The overhead bins have a capacity of 16 cubic yards each of coarse and fine aggregate and 1½ tons of cement. The whole of the cement aggregate handling plant is duplicated on the opposite side of the building.

From the bins the materials go to two Winget A.B.C. continuous mixers, each having an output of 30 cubic yards per hour. The flow of materials to the mixers is controlled by screw and belt conveyors, and the mixing itself is done on a continuously-moving conveyor belt, by a number of rotating arms. Water is fed continuously at a controlled

• Fig. 4. The concrete framework of an "Orlit" house nearing completion. The upper floor joists are in position, and special molds are being positioned to grout in ceiling joists.

• Fig. 3. A scene at the Glasgow Corporation building site, showing the erection of homes from precast wall units. Note the tubular steel jig visible on the right; also the special transport trailer (left).

rate. All the mechanism is driven by a single electric motor, so that the speeds of all components are synchronized. From the mixers the concrete flows by gravity to the molds on the ground floor.

The slabs are cast vertically in molds constructed from steel frames with perforated metal faces. There is a steel pallet at the bottom of the mold, which remains attached to the slab when the mold is stripped, and protects it from damage during handling. Reinforcements are spot-welded in another part of the plant and are inserted into the molds before pouring the concrete. The slabs are cured for 24 hours in steam at a temperature of about 120 deg. F. and are then removed from the opposite ends of the curing chambers to a storage area where they remain for a short time before delivery to the building site.

Figure 3 shows houses of this type in the course of erection, and also one of the special four-wheel trailers on which the slabs are conveyed. All these homes will be of two stories—that is two slabs high—and when suitable mobile cranes become available, it is hoped to be able to erect a complete house while the crane remains in one position. The walls are erected around jigs constructed of tubular steel scaffolding, the jig being removed by the crane after erection of the walls. All outer walls are 6 inches thick, and partition walls 4 inches. The houses are of the usual semi-detached pattern, the ground floor being of concrete laid direct on the ground. These concrete floors without basement or air space underneath, are by no means popular with householders, but have come into general use since the war on account of the saving in materials and labor which they effect.

Another remarkable installation in the Glasgow area is a machine, also of Winget manufacture, which produces large continuous-cavity blocks in sizes up to 8 by 8 by 32 inches. These also are made with foamed-slag aggregate, the inner and outer walls of the block being joined together by eight steel ties grouted in with a special liquid cement mix into holes in the inner and outer blocks. These unusual blocks are produced in face-down type molds, in a special semi-automatic machine having ten different stages, like an assembly line. In order to separate the inner and outer walls of the block during manufacture, a layer of clean sand is interposed. This is shaken out after the blocks are cured, and the sand is re-used. Curing is by steam in a tunnel of concrete pipes.

In the London area, considerable numbers of houses are being constructed on the "Orlit" system. These all-concrete homes conform

• Fig. 5. The "Orlit" house, showing special precast concrete wall slabs in the course of erection. Note the chimney (left) constructed from special blocks.

to the usual semi-detached style, with concrete ground floor. Their basic structure consists of a framework of concrete joists, as shown in Figure 4. The vertical members are provided with cast-in steel fittings by means of which they can be butt-jointed one to the other with nuts and bolts. Stubs for the fore-and-aft horizontal members are cast integrally with the vertical members, a sufficient length of reinforcement being left projecting to form a connection to the intermediate section of the horizontal member which can thus be of any suitable length. The joint to the intermediate section is cast *in situ* by means of special molds which can be seen in the illustration. Transverse horizontal members and floor members are I-section concrete joists.

Figure 5 shows the next stage in the erection of the "Orlit" house. Continuous cavity walls of special concrete slabs are built, the inner and outer panels being connected by steel ties. Partition walls are of the usual cinder slab construction, and the chimney is built of large rectangular hollow blocks. Figure 6 shows the structure nearing completion.

The special slabs forming the walls of the "Orlit" house are manufactured in a large modern plant at Colnbrook, near London. The slabs measure 16 inches high by 2 inches thick and are normally 48 inches long. They are dished on the unexposed face, for lightness. They are cast in concrete, using sand and gravel aggregate, with an external face of white or colored portland cement stucco cast integrally. They are molded face-upward in steel trays on chain conveyors which allow them to stop at suitable points for pouring, troweling, vibration and so forth. Reinforcement can be inserted if required. The molds are then loaded onto racks which are transferred to the curing tunnels through which they are moved continuously by means of a chain conveyor beneath the floor. Curing is in three stages: in the first the temperature rises to about 120 deg. F. with 100 percent humidity produced by wet steam. In the next stage the temperature rises to about 140 deg. F., and hot air is blown in to reduce the humidity. In the final stage the temperature falls to about 105 deg. F., and humidity is reduced to the minimum. The racks pass through the curing tunnels in about four hours. After curing, the molds go onto another chain conveyor which takes them under a surfacing machine with steel cutters which produce a tooled finish.

An important section of the precast concrete industry in Britain is the manufacture of sidewalk paving slabs and curbs. In most cities the sidewalks are paved with these slabs, which are mostly 24 inches wide and up to 36 inches in length; thickness is either 2 inches or 2½ inches. They are generally produced on hydraulic presses such as those manufactured by Fielding and Platt. The concrete is compressed at a pressure of 1,000 pounds per square inch of surface, producing a very strong, hard-wearing and practically impermeable slab. Sidewalks paved in this way are clean, dust-free and of pleasing appearance. The slabs are generally placed on a bed of sand and it is claimed that little skill is required in laying them and that the cost of a sidewalk of this type is lower than for poured concrete cast *in situ*. The advantage from the point of view of the city engineer is that the slabs can be taken up and replaced any number of times when access is required to water, electrical or other services buried under the sidewalks. The slabs are considered to have a life of at least 20 years.

Concrete curbs produced in the same way are extensively used. They measure either 5- by 10-inch or 6- by 12-inch cross section and 36 inches in length, and may be of plain rectangular section for use in city streets or of bevelled or "half-batter" section for use on inter-city highways. All new or modernized highways have curbs throughout

their length, giving control of the drainage of surface water and strengthening the edges of the road surface. No provision is made on British roads for vehicles to drive off the traveled surface onto a shoulder.

The hydraulic press used for the manufacture of slabs and curbs develops a total pressure of about 400 tons distributed over the surface of the slab. The machine has a rotating table on which are three identical steel molds, the arrangement being somewhat similar to a sand-lime brick machine. In the first position the mold is filled with a measured amount of concrete from an overhead hopper. A liquid mix is used, generally made with granite aggregate graded from 3/8-inch to dust, in the proportion of six parts of granite to one of cement. In the second position the pressure is applied and the excess of water squeezed out; loss of cement is prevented by sheets of paper at the top and bottom of the mold and by the close fit of the pressure head in the mold. In addition to the main pressure cylinder, the machine has two other hydraulic cylinders, one of which rotates the table in steps of 120 deg. through a ratchet system, and the other strips the finished unit from the mold by pushing it up from below. The concrete is, of course, very firm as a result of the pressure, and there is no possibility of slump. Offbearing is done by means of a hydraulic hoist, the unit being picked up by a large vacuum pad and transferred to a steel pallet on which it is cured. The operation of the various hydraulic cylinders is controlled by levers and pedals.

It will be observed that in this process it is necessary to line the top and bottom of the mold with paper (similar to wrapping paper) to allow the water to be expressed, using two sheets per unit.

The precast concrete industry in Britain today is in a flourishing state, and while it has developed along lines different from those familiar in the U.S.A., there are many interesting developments, and new ideas and processes are constantly being tried out. A certain amount of American machinery is being introduced for the production of precast building units, but this is limited by the strict Treasury control of dollar purchases.

Mammoth Precast Pipe

(*From page* 164)

The cradles are supported on reinforced concrete footings on the ocean floor. Synthetic rubber gaskets will be used to form watertight seals.

The Guy F. Atkinson Co. has, incidentally, the contract for the entire outfall sewer. At Hyperion, where the actual laying of the pipe takes place, a 2,400-ft. timber trestle has been constructed out into the ocean to a depth of 30 ft. Standard-gage railroad tracks have been laid on the trestle over which a locomotive crane will operate to place the sections underwater and to place the concrete footings. A Noble batching plant and two Koehring mixers have been installed at the Hyperion site.

Inshore sections of the sewer are 16 ft. long by 12 ft. inside diameter reinforced concrete pipe produced for the contractor by the South Gate plant of American Pipe & Construction Co. They are delivered to the site by truck.

The new outfall will have triple the carrying capacity of a leaky old 7-ft. line which it will replace and will extend seaward far enough to minimize shore pollution.

Charles H. Thompson is superintendent of the pipe-casting project at Terminal Island. David E. Root, vice-president and general manager of Atkinson's southern California operations, has general direction and supervision of the entire job.

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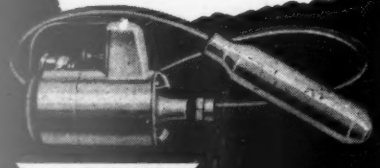

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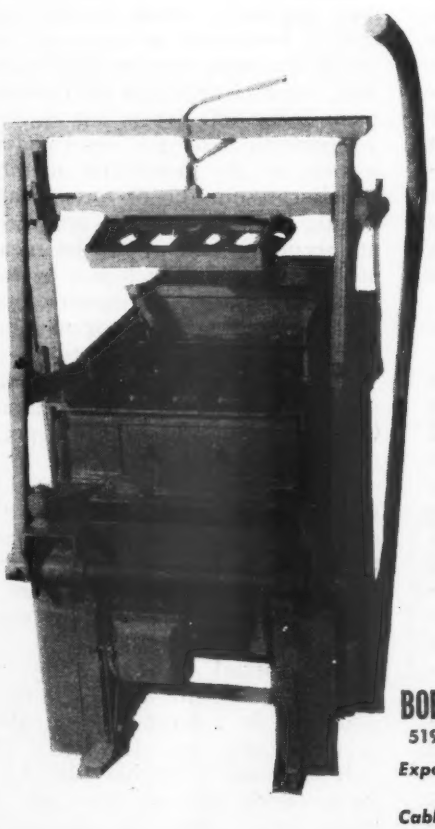

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Unique Sectional Concrete Fence Developed by California Concern

another ON THE SPOT report

ATTRACTIVE permanent fences made of precast reinforced concrete panels are being enthusiastically received in southern California, according to the Ackerman Concrete Fence Company of Santa Ana, Calif.

The concern manufactures the panels and makes the installations,

By HARRY F. UTLEY

and is also the general licensee for the process, holding the patent rights. A number of concrete-products and other concerns have already been franchised on the Pacific Coast and in the Southwestern states, and the firm expects to broaden its field of operations within the next year or so to serve the entire country.

Since operations were started in June, 1946, more than 200 installations were made by the Santa Ana plant alone, and output has been limited only by the size of the plant, scarcity of basic materials and labor.

The fence panels are made in various heights up to 5 feet, in 1-foot widths and 1¾ inches thick, and with different top designs, the semicircular finial proving the most popular. The panels are cast in gang

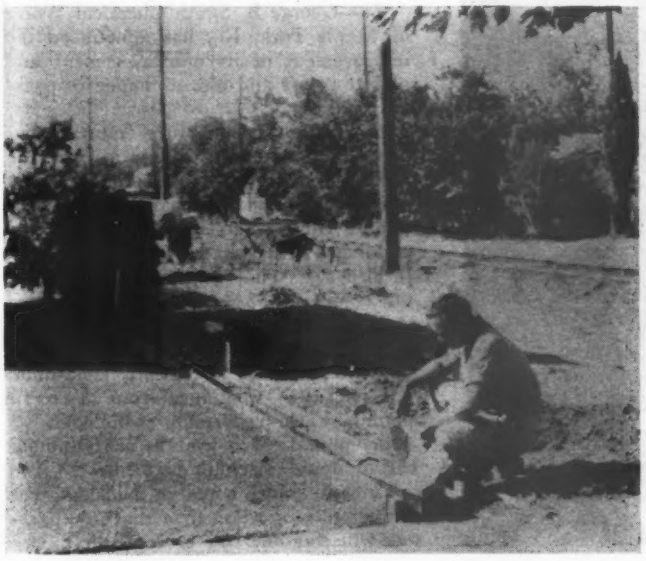
• Office building of the Ackerman Concrete Fence Company at Santa Ana, Calif.

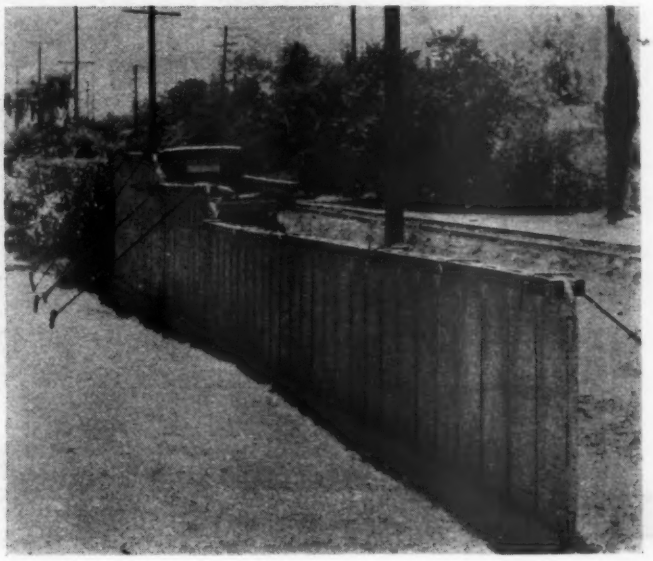
molds of from 17 to 20 units at a single pour, outer mold sections being of cast aluminum with steel plates separating the individual panels. The molds are cleaned and oiled before assembly to insure a smooth finish. Reinforcing consists of 16-gage steel strapping held in position by cross ties of wire. Concrete is mixed in a conventional revolving mixer and is designed for an ultimate strength of 3,000 pounds. Aggregates consist of sand and pea gravel, and a relatively wet mix is employed. The gang mold is mounted on a wooden skid, brought to the mixer with a lift-truck, and trundled away after pouring and rocking to insure complete filling. The slabs are left in the forms overnight and are removed the following day and stacked in the yard, being sprinkled frequently to insure thorough curing. Later on steam-curing will be employed as the Santa Ana plant is enlarged and improved.

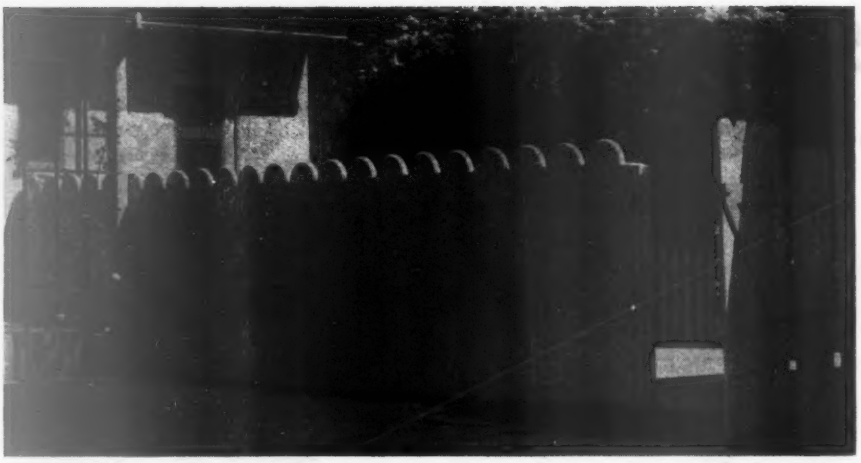
Installation crews erect the fences, the panels being held rigidly in position in a poured concrete base. This base has a depth of about 6 inches when completed and incorporates a slotted key-way into which the panels are inserted. Cement grout is applied to fill any voids or spaces in the foundation and steel supporting clamps are left in position for about 24 hours to keep the fence panels in perfect alignment until the grout has set. The tops of the panels are then permanently joined by a plastic compound poured into a dowel-like recess. This quick-hardening compound makes the

• Below, left: The form for pouring the concrete base of the fence has been put in place. Note the slot into which the panels are to be inserted.

• Right: The fence panels, inserted in the concrete base, are ready for grouting. Note the clamps for holding the panels in alignment until they are set.







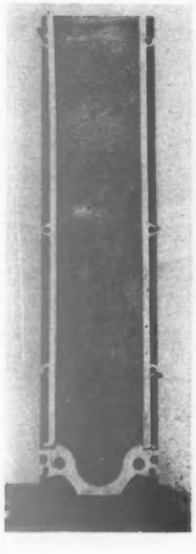
• A typical back yard residential installation of concrete fence.

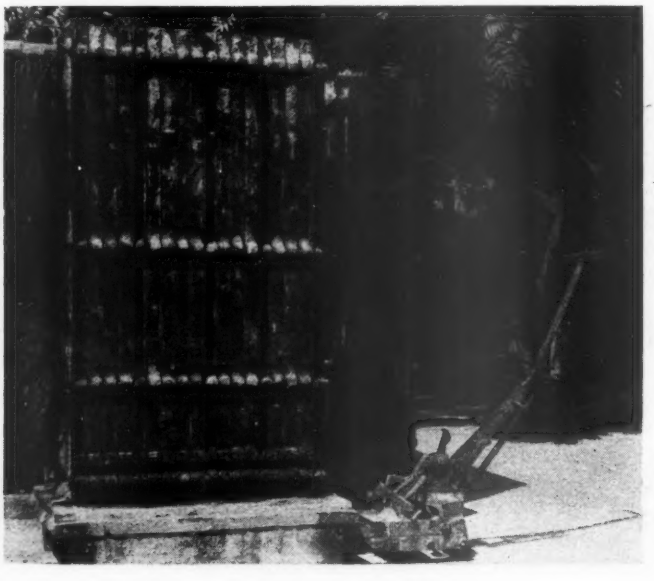
fence completely rigid. After the fence has been painted the desired color to harmonize with the surroundings, the job is complete.

The feature of the fencing which has made it so popular is, that it is truly permanent — rotproof, rustproof, fireproof, and safe from destruction by termites. Unlike wooden fencing which it simulates, it has no posts or runners to mar its appearance, both sides being alike. Although more expensive initially than wood (it costs from $3 to $6 per lineal foot installed and painted) the first cost is the last. Compared with brick or concrete-masonry walls which have similar permanent characteristics, the cost is 20 to 25 percent less, the company reports.

The idea was developed several years ago by James L. Ackerman of Santa Ana. After obtaining patents and perfecting manufacturing and marketing plans, the company was organized and is presently headed by F. D. McGurk and James V. Scobie. C. K. Tuttle is manager of the operations at Santa Ana, where from 10 to 20 men are employed in production and installation.

H. L. Pratt is the company's franchise representative. Arrangements for the manufacture and installation are on a protected territory-royalty basis.





• Left: One unit of a gang mold of fence panels. The large rectangular section is steel; the side molds are cast aluminum.
• Right: A fence panel gang mold assembly ready for pouring. Note the skid and the lift truck.

Certified Concrete Products Opens Grand Rapids Plant

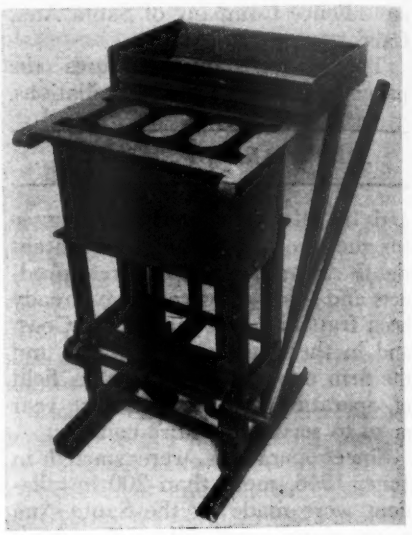
A $60,000 concrete products plant capable of turning out 3,500 blocks a day has been put into operation at Grand Rapids, Mich., by Certified Concrete Products. Jerome W. Sonefeld, general manager and secretary-treasurer, said that the plant will specialize in the production of cinder blocks. The president of the firm is Lloyd C. Pender.

At the Corpus Christi Interlocking Tile Company, Corpus Christi, Tex., two hydraulic power block machines manufactured by the Mortarless Tile Machine Co., Inc., of Los Angeles were recently established for the production of Interlocking units.

NEW MACHINERY and SUPPLIES

• Hand Block Machine

The Model "H" hand-operated concrete block machine manufactured and marketed by the Franklin Machinery Company, 326 Franklin Street, Bloomfield, N. J., has an all-steel electric-arc-welded mold box which produces a standard 8- by 8- by 16-in. three-oval core block. Full core, half block or corner block can also be made; and additional plates are available for making any of these combinations simultaneously—two half blocks, two quarter blocks and one half block or one quarter block and one three-quarter block.



Versatile block maker

The machine is equipped with three full cores and two half-end cores, all oval. Metal pallets are available in multiples of 50. The approximate weight of the machine is 175 lb.

• New Pigment Packaging

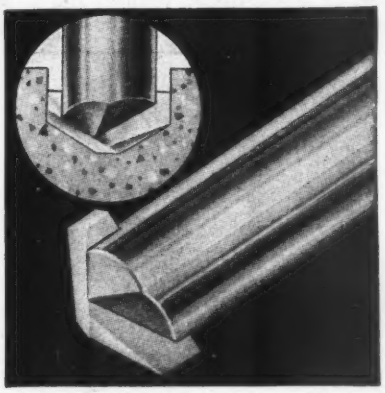
The George B. Smith Chemical Works of Maple Park, Ill., has announced the improvement of its mortar, cement and plaster colors and also a change in packing facilities.

Instead of packing the mortar pigments in 100-pound sacks, as was the former practice, the manufacturer now puts these up in fiberboard cartons containing from 12 to 30 pounds each, depending on the shade. (Six colors are furnished.) The "Super Strength" mortar colors are 3⅓ to 8 times stronger than the old-type "Double Strength" mortar colors which were packed in 100-pound sacks. Cartons containing six packages weighing from 3 to 5 pounds each reportedly will color as many pounds of mortar as a 100-pound bag of double-strength pigment.

Cement colors come in packages scientifically proportioned so that one package will tint one bag of cement.

• Carbide Drill Tips

"Kennadrills," newly-developed by Kennemetal, Inc., of Latrobe, Pennsylvania, for work in nonmetallic construction materials, are now in production. These drills have cutting tips of Kenna-



No chipping or cracking

metal, a cemented carbide that is claimed to be harder than tool steel, highly resistant to abrasion and unusually strong. The drills have been designed so that the tip extends beyond the diameter of the shank, providing clearance space for cuttings, minimizing the possibility of binding and permitting the drill to eject cuttings continuously from the hole.

No starting punch is required when Kennadrills are used on very hard or brittle materials, and glazed surfaces are not chipped or cracked because the tip takes hold readily; the tip stays hard and sharp under the heat of cutting. The tool retains its edge under abrasive cutting, yet it can be sharpened on loose bonded silicon carbide wheels.

Kennadrills are available in sizes from ¼ inch through ½ inch for ¼-inch capacity drills, and ½ inch through 1 inch for ½-inch capacity drills.

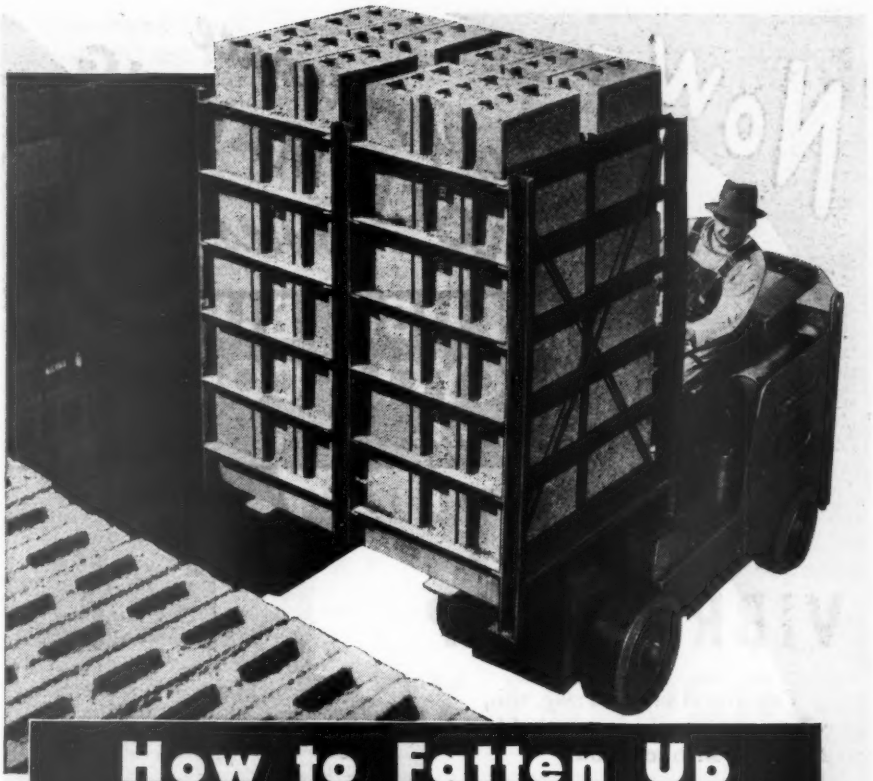
• Waterproofing

Products for waterproofing, preserving and refinishing cement and cinder block products are being marketed by the Evercrete Corporation, 424 W. 42nd Street, New York 18, N. Y. The products are known by the trade names of "Stopzit," "Evercrete," "Kleencrete," "Colorthru" and "Hercules Speedy Patch."

Stopzit is a paint, available in 14 colors, which is prepared in a powder form, and is ready to apply with brush or spray after mixing with cold water. It is used to waterproof porous masonry surfaces, and is washable when dry.

Evercrete is a chemical which impregnates masonry without changing the color or appearance of the surface, and changes the surface components into a solid mass, rendering the surface waterproof. The treated surface is said to be resistant to acids and oils as well.

Kleencrete is a cleaner, which will remove oils, grease, gasoline, fats and other foreign matter from concrete, stucco, mortar, etc. In addition, it is said to "cure" the concrete by sealing the pores.



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"PUSH BUTTON" CYCLE CONTROL in the

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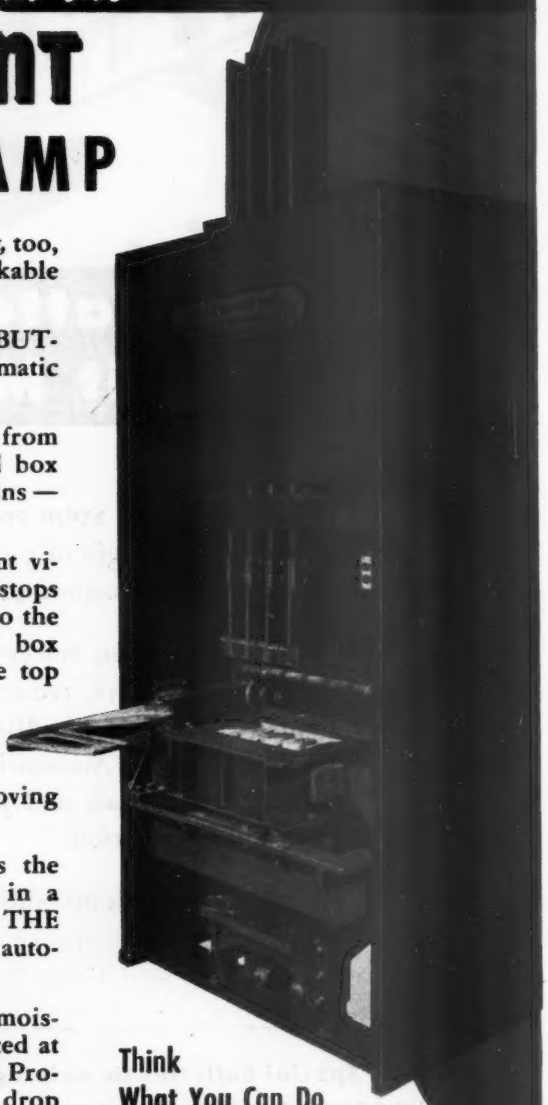

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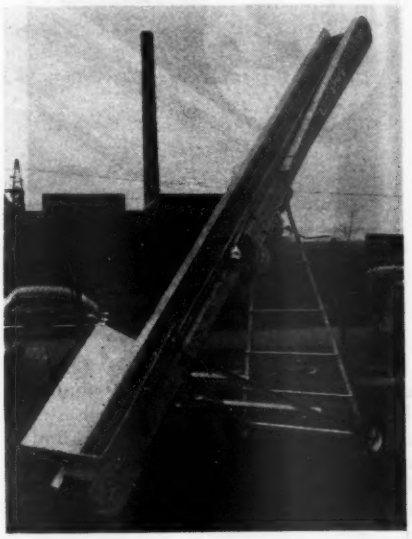
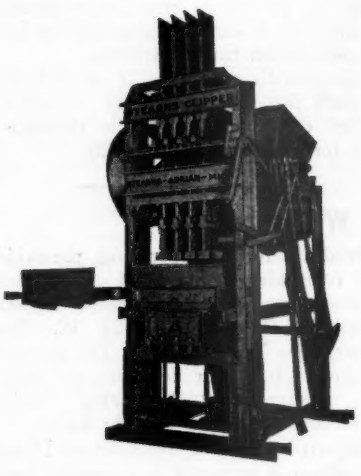


• Shown above is the "Model B" Power Pack conveyor, a bucket-type portable belt conveyor, manufactured by the Conveyor Repair Service, Inc., 13910 Aspinwall Ave., Cleveland, O. This unit is designed to handle many different types of aggregates, such as sand, cinders and gravel.



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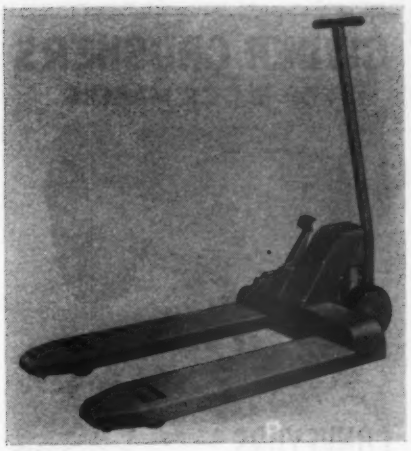

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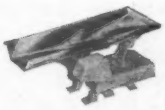

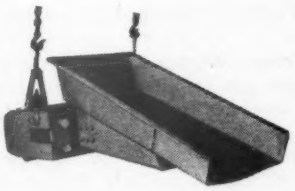

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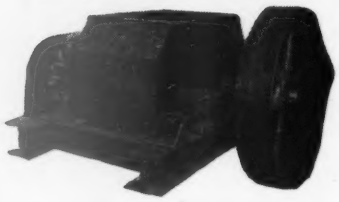

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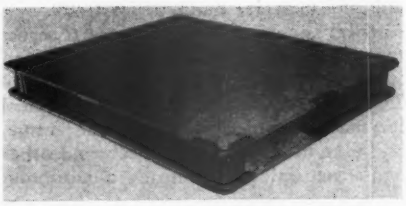


Pallets used with fork lift trucks

tractor, Battle Creek, Mich. Constructed from ⅝-inch plywood decks and posts of plywood blocks or metal, the pallet weighs only a little more than half as much as a comparable hardwood pallet. It is double-faced, designed for four-way fork entry, and can be furnished in the metal-post construction for use with hand-lift or motorized pallet trucks. Capacities are 4,000 pounds carrying load, and 16,000 pounds static load.

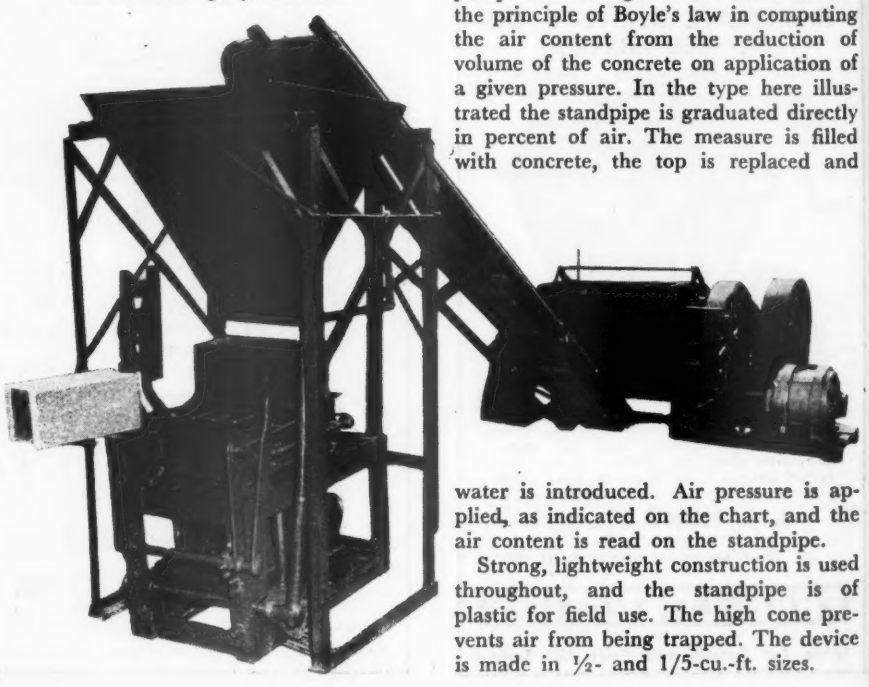
● Heavy-Duty Machine

The Mighty Midget block machine, manufactured by the M and M Industries, 3919 N. 27th Street, North Birmingham 7, Ala., is heavy-duty equipment designed to meet the demands of high production. The machine is powered by a 1-hp. motor and is of all-welded heavy steel construction.

The conveyor is 12 ft. by 8 inches; it is equipped with belt-cleaners and an idler. Power is furnished by a 1-hp. motor.

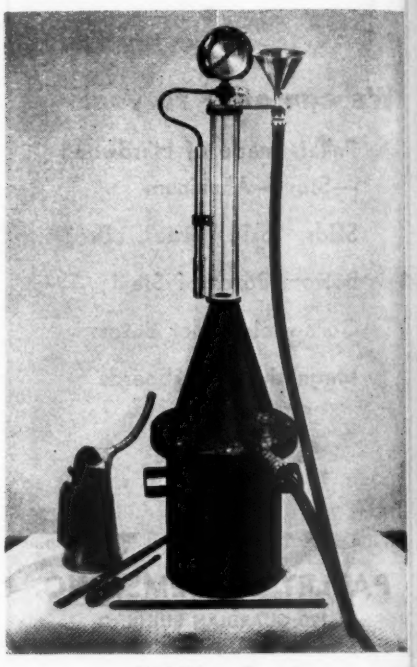
Controlled vibration gives 6500 packing blows per minute. The lined mold box is mounted on live rubber. Cores are of cast iron. The tested capacity is 1900 units of 8- by 8- by 16-inch size per day or 2500 4- by 8- by 16-inch units.

Machine for high production.



● Air-Entrainment Meter

Hogentogler and Company, 16 Oxford Street, Chevy Chase, Md., are now offering the Klein-Walker air meter, a portable device developed by W. K. Klein and Stanton Walker for measuring the amount of air entrained in concrete. (Mr. Klein is a former vice-president of



Portable meter.

the Pennsylvania-Dixie Cement Corporation, and Mr. Walker is director of engineering for the National Ready Mixed Concrete Assn.)

Comprehensive studies were made by L. C. Hawk of the Pennsylvania-Dixie Cement Corporation and D. L. Bloem for the National Ready Mixed Concrete Association.

The complete meter consists of a measure, a cone-shaped top, with graduated standpipe, a test gauge, hose, air pump and fittings. The device utilizes the principle of Boyle's law in computing the air content from the reduction of volume of the concrete on application of a given pressure. In the type here illustrated the standpipe is graduated directly in percent of air. The measure is filled with concrete, the top is replaced and water is introduced. Air pressure is applied, as indicated on the chart, and the air content is read on the standpipe.

Strong, lightweight construction is used throughout, and the standpipe is of plastic for field use. The high cone prevents air from being trapped. The device is made in ½- and 1/5-cu.-ft. sizes.